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A REVISION OF THE CLASSIFICATION OF THE NORTH AMERICAN PATELLIFORM ANCYLIDAE, WITH DESCRIPTIONS OF NEW SPECIES.

BY BRYANT WALKER.

The North American patelliform species of *Ancylidae* can be conveniently and naturally arranged in eight genera and subgenera according to their shell characters. These can again be grouped into three subfamilies characterized by the peculiarities of the radula and jaw.

It was hoped that a study of the soft anatomy might reveal other peculiarities co-ordinating with those of the radulae, and for that purpose with the kind assistance of correspondents in England, South Africa and this country a very considerable amount of alcoholic material, representing nearly all of the characteristic groups, was collected, some of which will be very difficult to replace. This material was placed in the hands of a distinguished zoologist, who undertook to work it up. After appropriating and using the material thus obtained, it was a matter of bitter disappointment, after having waited for three years for the completion of the work, reported from time to time to be in progress, to be informed by the gentleman that he should not proceed further with the work as he did not think that it would "pay for the trouble considering the more important anatomical details that await study among other families of mollusks."

Under these circumstances the subfamilies represented in our

fauna must for the present be based wholly upon the peculiarities of the radula and jaw.

The arrangement of the *Ancylidae* proposed by Hannibal, (Pr. Mal. Soc. Lond., vol. x, 1912, p. 147), is not based upon any distinctions of systematic value. The genera and subgenera arranged under the different subfamilies are entirely heterogeneous and in several instances genera and their subgenera appear in different subfamilies. The whole arrangement is absolutely futile and must be entirely disregarded.

The arrangement that I would propose is as follows:—

I. Subfamily Lancinæ, Hannibal.

Jaw as in *Lymnaea* with two accessory plates. Radula also Lymnaeid in character. Central tooth unicuspid or tricuspid, laterals bicuspid with large quadrate bases, marginals comb-like, the cusps extending beyond the base.

This group was proposed, but without any definition, by Hannibal (Naut., vol. xxviii, 1914, p. 24).

Genus Lanx Clessin.

Lanx Clessin, Con. Cab., Ancylinen, 1880, p. 10.

Type, *Ancylus newberryi* Lea. Example, *Lanx patelloides* (Lea). Pl. 2, fig. 1.

Subgenus *Walkerola* Hannibal.

Walkerola Hannibal, Pr. Mal. Soc. Lond., X, 1912, p. 149.

Type, *Lanx* (*Walkerola*) *klamathensis* Hannibal, Pl. 2, fig. 2.

Conchologically *Walkerola* appears to bear the same relation to *Lanx* that *Lævapex* does to *Ferrissia.*

Genus Fisherola Hannibal.

Fisherola Hannibal, Pr. Mal. Soc. Lond., X, 1912, p. 151.

Type, *Fisherola lancides* Hannibal.

Nothing has been published on the soft anatomy. It is placed here on account of its size, shape and habitat.

II. Subfamily Ferrissiinæ, n. subf.

Jaw segmented in plates. Radula with a bicuspid central, laterals obliquely reflected with from two to five small cusps

arranged somewhat like the teeth of a comb, marginals also comb-like, cusps not (usually) extending to the basal line.

Genus Ferrissia Walker.

Ferrissia Walker, Naut., XVII, 1903, p. 15.

Type, *Ancylus rivularis* Say. Pl. 2, fig. 3.

Subgenus *Lævapex* Walker.

Lævapex Walker, Naut., XVII, 1903, p. 15.

Type, *Ancylus fuscus* C. B. Adams. Example, *Ferrissia* (*Lævapex*) *diaphana* (Hald.). Pl. 2, fig. 4.

For reasons stated elsewhere (Naut., XXVI, p. 117), I can not follow Hannibal in subordinating *Ferrissia* to *Lævapex*. I agree fully with Gwatkin (J. of Con., XIV, 1914, p. 147), that *Ferrissia* represents the most primitive type of radula, so far as yet known, in the *Ancylidæ*. The world-wide distribution of the genus is evidence tending in the same direction. *Lævapex* is restricted to America and is, to my mind, clearly an offshoot from the more ancient *Ferrissia* stock. In addition to its peculiar shell characters, there is some evidence tending to show a slight divergence also in the character of the lateral teeth, but hardly sufficient to justify its generic distinction.

Genus Gundlachia Pfeiffer.

Gundlachia Pfeiffer, Zeitschr. fur Malak., VI, 1849, p. 98.

Type, *Gundlachia ancyliformis* Pfr. Pl. 3, fig. 1.

Poeyia Bgt., (1862), and *Kincaidella* Hann., (1912), are synonyms, being based on immature or non-septate stages, but the latter name may be retained for the group with striate apices.

Gundlachia, like *Ferrissia*, includes two groups characterized by the presence or absence of radial sculpture on the apex.

I have examined all of the described species except *G. crepidulina* Guppy from Trinidad and *G. lucasi* Suter from New Zealand.

Sub-genus *Gundlachia* s. s.

Apex smooth, except for light concentric wrinkles. Type, *Gundlachia ancyliformis* Pfr., Cuba.

The following species also belong in this group:

G. bakeri Pils., Brazil; *hinkleyi* Walker, Guatemala and *hjalmarsoni* Pfr., Honduras and Texas.

Sub-genus *Kincaidella* Hannibal.

Apex radially striate.

Kincaidella Hannibal, Pr. Mal. Soc., London, XII, 1912, p. 143. Type, *Ancylus fragilis* Tryon—*Gundlachia californica* Row.

Californica Rowell, (March, 1863), has priority over *fragilis* Try., (June, 1863), if the date given by Binney, (L. and F. W. Sh., II, p. 149), is correct.

Kincaidella also includes the following species:

G. beddomei Pett. (MSS.), and *petterdi* John. from Tasmania; *neozelanica* Suter from New Zealand; *l'hotelleriei* "Bgt." Walker from Egypt; a species as yet undescribed from Cape Colony, S. Africa; *californica* Rowell, *meekiana* Stimpson, *stimpsoniana* S. Smith and undetermined species from Starved Rock, Ill. and Mobile, Ala., from the United States.

The generic position of *Ancylus woodsi* John. from Tasmania would seem to be somewhat uncertain, (see Hedley, NAUT., IX, p. 66), but, if not a *Kincaidella*, it is a *Ferrissia*, as the apex is radially striate.

It is interesting to notice that *Gundlachia* s. s. is apparently restricted to the countries bordering the Gulf of Mexico and seems to be a purely American group, similar to *Lævapex*, while *Kincaidella*, like *Ferrissia* s. s., has a range extending quite around the globe. If a natural rather than an artificial system of nomenclature could be used, *Kincaidella* would represent the older and really typical group and *Gundlachia* s. s., as a more recent off-shoot from the original race, would become a subgenus.

I have not seen Troschel's description of the radula of *G. ancyliformis* mentioned by Hedley, (NAUT., IX, p. 62). The radulæ of the three American species that have been figured, *californica*, *meekiana* and *hinkleyi*, are all very similar to each other and quite different from that of either *Ferrissia* or *Lævapex*. That of *G. neozelanica* Suter as figured in T. N. Z., XXVI, pl. 14, fig. 5 is similar in the small number of cusps on the

side teeth, but differs in having them longer and sharper, those of the marginals extending beyond the base. This characteristic difference in the radula would seem to definitely establish the generic validity of the group.

III. Subfamily Rhodacmeinæ, n. subf.

Jaw composed of numerous segmented plates. Radula with a long, slender central, unicuspid or faintly bicuspid, and with the base widely expanded in some species: the first lateral very large with an enormous mesocone, the blade-like cusp extending beyond the base, the ectocone is back of the mesocone, entirely separated from it and has several small cusps; there is no endocone. The four laterals are similar in shape but diminish rapidly in size toward the margin, these are succeeded by two or three transition teeth, smaller and with more or less imperfect cusps. The marginals are very small, rapidly decreasing in size toward the outer edge, with large quadrate bases, wider than high, vestigial, the cusps being nearly, if not quite, obsolete.

The rows of teeth are more or less V-shaped and with the immense laterals and minute marginals present a remarkable appearence quite unlike any other group belonging to the family.

Gwatkin, (J. of Con., XIV, 1914, p. 147), has already commented upon the resemblance of the radula to that of *Brachypodella*.

All of the species known to belong to this group have the apex of the shell tinged with pink.

Genus Rhodacmea, n. g.

Shell patelliform, conical, elevated or depressed, apex tinged with pink. Radula and jaw as in the subfamily. Soft anatomy otherwise unknown.

Type, *Ancylus filosus* Conrad. Pl. 3, fig. 2.

The species belonging to this genus are not confined to the Coosa drainage as Gwatkin supposed, but are also found in both the Tennessee and Ohio systems.

As in *Lanx* and *Ferrissia*, two well marked groups are repre-

sented in this genus, the one with an elevated and the other with a depressed shell.

Section *Rhodacmea*, s. s.

Shell elevated. Radula with a unicuspid central, which has the base triangularly expanded; laterals with the cusp of the mesocone extending but little beyond the base and not overlapping the base of the central tooth.

Type, *Ancylus filosus* Conrad.

I. Rhodacmea filosa (Conrad).

Ancylus filosa Conrad, F. W. Shells, 1834, p. 57.

When I wrote of this species in 1904, (Naut., XVIII, p. 75) I had not seen any specimens from the Black Warrior River, Conrad's original locality. The specimens then before me as was stated, were not typical in that they lacked the "numerous, radiating, prominent lines" described by Conrad. Since that time a considerable amount of additional material has been received from Mr. H. H. Smith, which fully confirms the original diagnosis. One set from the Black Rock Shoals of the Black Warrior River are rather thin, of a light translucent green color with the apex tinged with rose and are very strongly radiately striate, the ribs extending from the apex to the periphery. The largest specimen measures 4.25 x 3 x 2 *mm.* These shells are undoubtedly typical.

Similar specimens are before me from the Coosa River from several localities, viz., two miles above Coosa Valley, St. Clair Co.; Ten Island Shoal near Lock no. 2; Leota Shoal; Three Island Shoal, Wilsonville, Shelby Co.; and Vincent Shoal, two miles above Upper Clear Creek. Also from Tallassahatchee Creek, four miles east of Childersburg; Beaver Creek at Greensport and Canoe Creek.

All the shells from these localities are quite typical in form, but are uniformly thicker and more heavily striated than the Black Warrior specimens. This heavily striated form seems to be the characteristic expression of the species in the Coosa and its tributaries. The Cahawba River specimens from Lewis and Call mentioned in my former paper, while lacking the strong

radial striae, are in texture and shape like the typical shells from the Black Warrior. While this smoother form quite probably represents a local race worthy of recognition, as it has not been found by more recent collectors and no exact localities for it are known, it hardly seems advisable to do more than to call attention to its peculiarities until more definite information as to its precise range can be had.

RHODACMEA CAHAWBENSIS, n. sp. Pl. I, figs. 4–6.

Ancylus filosus Walker, NAUT., XVIII, 1904, p. 76, pl. vi, figs. 1–6.

Shell elevated, obtusely conical, broad oval, somewhat wider behind the apex than before it; apex obtuse, slightly behind the longitudinal centre of the shell, scarcely, if at all, turned toward the right side, apical sculpture entirely eroded in all specimens seen; yellow horn color slightly tinged with green, apex rose color; anterior slope convex toward the apex, straighter below; posterior slope nearly rectilinear; lateral slopes slightly convex, the left being more oblique than the right; lines of growth strong and irregular, slightly rippled by radial lines, which sometimes become obsolete radial striæ.

Length 4.5; width 3.5; alt. 2.5 mm.

Types, (no. 43453 Coll. Walker), from the Cahawba River, Gurnee, Shelby Co., Ala., collected by H. H. Smith. Cotypes in the collections of the Acad. of Nat. Science, Philadelphia, George H. Clapp and John B. Henderson. Also from Cahatchee Creek and Yellowleaf Creek, Shelby Co., Ala. The single specimen from the latter locality shows subobsolete radial striation very much like the "Coosa River" specimens in the Lewis collection which in my former paper I referred to *filosa*, but which I now think belong to this species. The fact that the heavily striated *filosa* is quite characteristic of the Coosa, where this species has not been found by Mr. Smith in his extensive collections, makes me doubt whether the Lewis shells really did come from the Coosa itself. Unfortunately no exact locality is given by Lewis and the question must remain undetermined.

This species is more closely related to the *elatior* Anth. of the Tennessee drainage than to any of the known species of the

Alabama system. Compared with that, it is smaller, narrower, with a more obtuse apex, the posterior slope is straight and not convex and the lateral slopes less oblique than in that species. The tinted apical area seems smaller than in the other species of the genus and is frequently lost entirely from erosion. The radula has not yet been examined.

RHODACMEA ELATIOR (Anthony).

Ancylus clatior Anthony, Ann. N. Y. Lyc., VI, 1855, p. 158, pl. v, fig. 20.

No additional information in regard to this species can be given at this time except that the radula of a specimen from the Tennessee River at Florence, Ala., collected by Hinkley agrees with that of *filosa* in the characters of the central and lateral teeth. A very considerable collection from the Tennessee made by Mr. H. H. Smith has not yet been worked over and may add materially to our knowledge of the species when critically examined.

RHODACMEA HINKLEYI (Walker).

Ancylus (*Ferrissia*) *hinkleyi* Walker, NAUT., XXI, 1908, p. 139, pl. lx, figs. 11–13.

The species listed from the Tennessee River at Florence, Ala., as "*Ancylus rhodaceus* Walker" by Hinkley in 1906, (NAUT. XX, p. 40), but not described, is the same as that subsequently described under this name in 1908. The radula of the Tennessee River specimens agrees with those of *filosa* and *elatior* in sectional characters.

Section *Rhodocephala*, n. sect.

Shell depressed. Radula with a faintly bicuspid central which has the sides of the base straight and not expanded; laterals with the cusp of the mesocone extending far beyond the base and overlapping the base of the central tooth.

Type *Rhodacmea rhodacme* Walker.

RHODACMEA RHODACME, n. sp. Pl. I, figs. 1, 2 and 8.

Shell depressed, conical, obovate, the greatest width being

just behind the apex, apex subcentral, only slightly behind the centre, obliquely elevated, acute, spine-like, somewhat turned toward the right side, finely radially striate, apical depression small, oval and situated on the left side of the tip of the apex; pale green with the apical region deeply tinged with rose color; anterior slope very slightly convex; posterior slope oblique and nearly rectilinear below the base of the apex; lateral slopes slightly convex and about equally oblique; growth lines regular, fine and distinct, the apical striae extend down over the upper part of the shell giving a shagreened appearance to the surface as they intersect the growth lines, but become mere ripples toward the margin.

Length 5.25, width 4, alt. 1.25 mm.

Types, (No. 20371 Coll. Walker), from the Coosa River at Williamsville, Shelby Co., Ala., collected by A. A. Hinkley. Cotypes in the collection of Mr. Hinkley. Also from the Coosa River above Wetumpka (Hinkley) and at Leota Shoals; Fort William Shoals; Shoal two miles above Coosa Valley; Vincent Shoal two miles above Upper Clear Creek and Peckerwood Shoals (H. H. Smith).

All of the Smith shells were found on or under stones, which is apparently the usual habitat of the species, differing in this respect from *filosa*, which is almost invariably found on living *Pleuroceridæ*.

I have adopted for this species the very appropriate name suggested by Dr. Pilsbry soon after its discovery.

The peculiar depressed shell of *rhodacme* with its spine-like apex and characteristic radula differentiate it very sharply from the species included under *Rhodacmea* s. s. and justifies the establishment of a special section for it and similar species.

Rhodacmea gwatkiniana, n. sp. Pl. I, figs. 3, 7 and 9.

Shell rather small, depressed conic, oval; apex nearly central, somewhat turned to the right, acute and spine-like, finely radially striate; apple-green with the apex tinted with old-rose color; anterior slope slightly convex; posterior slope oblique and nearly straight below the projecting apex; lateral slopes straight below the base of the apex and equally oblique; growth

lines rather coarse and irregular, the entire surface covered with low, coarse, rather distant radial striae extending to the edges.

Length 3.5, width 2.5, alt. 1 mm.

Types, (No. 43454 Coll. Walker), from Butting Ram Shoals, Coosa Co., Ala., collected by H. H. Smith. Cotypes in the collections of T. H. Aldrich, George H. Clapp and John B. Henderson.

All of the specimens were found on living *Pleuroceridæ*.

This beautiful little species, which groups with *rhodacme* in its depressed shape and spine-like apex as well as in its radular characteristics, differs from it in its small size, more regularly oval shape and the greater development of radial striæ over the surface.

It is named in remembrance of the late Rev. Prof. H. M. Gwatkin of Cambridge, England, to whom I am indebted for practically all of the radula preparations used in this paper and who was the first to observe and point out the remarkable character of the radula in the different species of the genus.

I am indebted to Dr. Pilsbry for the slide representing the radula of *Lanx patelloides*. All of the other radulæ figured were prepared by Prof. Gwatkin, and all of the figures were drawn by Mrs. Lydia M. H. Green formerly connected with the U. S. National Museum.

A NEW SPECIES OF ASTARTE FROM ALASKA.

BY WILLIAM HEALEY DALL.

In 1865 Dr. Philip Carpenter described from a single specimen a species of *Astarte* from Puget Sound, to which he gave the specific name of *compacta*. This type remains in the collection of the National Museum as number 4509.

This species has remained extremely rare, only three or four others, some eroded and doubtful, have come to hand during the half-century which has passed. This is probably due to the fact that the right locality had not been dredged, for the

species of this genus are usually very abundant in their chosen places.

Recently Mr. G. Willett, warden of the Forrester Island reservation in southern Alaska, has succeeded in getting an excellent shell-collection at this isolated spot; among the shells thus obtained was a good series of *Astarte compacta*. With this, and for a time confused with the latter, is what seems to be a new species of *Astarte*, which Mr. Willett in arranging his collection was the first to discriminate. He had the kindness to send me his fine mounted series of both species for examination, the result of which is not only that a new species is identified, but it is shown that *A. compacta* as well as the new form belong to the typical section of the genus, both forming at intervals crenulation of the inner margin of the valves. The only specimens of *A. compacta* previously available happened to be in the stage without crenulations.

The new form is best described by a comparative diagnosis.

ASTARTE WILLETTI, n. sp.

Shell small, of a yellowish-brown externally, milk-white internally; the external sculpture of small concentric waves is more regular and constant than in *compacta*; the form is more oval and the beaks more anterior than in that species, and *willetti* appears to attain a larger size. In *compacta* the lunule is relatively narrower and longer than in the new species. In the interior the hinge of the latter is better developed than in *compacta*, all three teeth being usually represented, while in *compacta* the posterior and particularly the anterior cardinal is frequently obsolete or absent. The shell substance of *A. compacta* is more translucent and bluish, and the crenulations of the valve margin when present are distinctly smaller and less conspicuous than in *willetti*.

The measurements of two forms are as follows, the largest specimen of a series of some twenty-five specimens being selected in each case.

	Height.	Length.	Diameter.
A. willetti	14	16	8 mm.
A. compacta	12	12	6 mm.

The specimens were dredged in about 50 fathoms. The umbones in *A. willetti* are 6.0 mm. behind the anterior end of the shell; in *A. comparta* about 5.5 mm., the result being that the latter has a more triangular outline. The type of *A. willetti* is number 216364 of the catalogue of mollusks of the U. S. National Museum.

NOTES ON BOREAL LAND AND FRESHWATER SHELLS.

BY WM. H. DALL.

The National Museum has received a small lot of fresh-water shells from Dr. T. E. Winecoff, stationed at Fort Yukon, Alaska, nearly on the Arctic circle, which are of more than ordinary interest. They were collected from a small pond near the fort and the large *Lymnaea* abounded in such numbers as to give a pinkish tint to the water in which they were, according to the collector. The species are:

Lymnaea appressa Say, rather small for the species, and of a brownish tint not unlike the usual color of *L. palustris*.

Lymnaea palustris Müller. Ordinary type and size.

Lymnaea emarginata mighelsii Binney. Not known so far northwest.

Planorbis trivolvis Say, medium size, abundant.

Planorbis crista Linné, one specimen. Nearest known locality is Carberry, Manitoba.

Pisidium vesicularе Sterki, one specimen.

During a cruise in Bering Sea last summer, Mr. G. Dallas Hanna touched at St. Mathew Island in the northern part of Bering Sea. From small ponds in the island he obtained the following species:

Aplexa hypnorum Linné.

Planorbis parvus Say.

Valvata mergella Westerlund.

Pisidium scutellatum? Sterki.

Succinea chrysis Westerlund.

Several times during the last few years I have received the two forest snails *Polygyra columbiana* and *Circinaria vancouverensis* from Unalashka. At first I felt confident that some error had occured in labeling, as during my visits at that locality, 1871 to 1880, there was no grove or forest to shelter them and assiduous collecting failed to reveal their presence. However, in 1899 I found the transplanted Sitka spruce planted on one or two of the islets in the bay had made an extraordinary growth, and as these snails are always associated with the spruce and fresh specimens have been lately received from the locality, I can no longer doubt that the introduction of the species and its acclimation have been successful. The *Circinaria* are small and of a dark olive-green, the *Polygyra* normal.

A NEW CALIFORNIAN SIGARETUS.

BY MRS. IDA S. OLDROYD.

SINUM CALIFORNICUM, n. sp.

Shell white, convex, spirally striate above, with epidermis of a rusty yellow; a thin columellar callus reflected nearly over the umbilicus showing only a faint trace of umbilicus; interior snow-white. This has been called *Sigaretus debilis* Gld., but it is not like the specimens from Lower California. It differs from *S. concavum* in not being as convex, and the interior being white, and the early whorls are much smaller, and from *S. debile* in being convex and larger. *S. debile* is very flat, the early whorls are smaller and fewer. Length of shell 38 mm., breadth 18 mm., height 18 mm.

The type comes from San Pedro, California. The type and nine specimens are in the Oldroyd collection at Stanford University. Others are in the collection of the U. S. Nat. Museum, from localities ranging from Monterey, Cal., to Todos Santos Bay, Lower Cal.

A NEW SONORELLA FROM ARIZONA.

BY S. S. BERRY.

Mr. George Willett has sent in specimens of a *Sonorella* from Gila County, Arizona, which do not seem referable to any of the described species. A diagnosis is accordingly offered below.

SONORELLA ROOSEVELTIANA new species.

The shell is depressed. In the type the spire is low conoidal, but in some specimens is higher, while in others is raised but little above the level of the principal whorl; umbilicate, the umbilicus contained about eight times in the major diameter; very thin and fragile. Whorls 4¼ to 4½. Embryonic whorls a little less then 1½, the initial half-whorl very finely, irregularly, radially, wrinkled-costulate, the wrinkles becoming finer and more wavy in the following whorl, where they are crossed by a series of fine, delicate, raised lines, passing obliquely downward and forward from the summit of the whorl to the suture, the sculpturing sometimes showing with beautiful regularity over most of the whorl. Yet when a series of shells is examined the finer sculpturing shows great variation. Frequently the incised lines are more or less interrupted, especially near the summit, into elongate papillae which later coalesce. Sometimes lines or papillae are evident running in a direction counter to those just described and intersecting them. Above the summit, where the wrinkly lines of growth come closer together, the appearance is more granular and less distinct, but occasional traces of similar lines apparently pass obliquely downward (actually *upward* on account of the depression of the whorl at the suture) and backward from the superior suture to the summit. In most of the specimens the fine wrinkling becomes almost granulose. The next whorl-and-three-quarters show irregular growth-lines crossed obliquely by lines of minute papillae, though I can make out no bristles with the aid of such magnifying power as happens to be by me. The last whorl is apparently smooth except for the lines of growth. This whorl is moderately wide and descends slightly in front. The aperture

is subcircular and very oblique. The peristome is thin, its margin only slightly thickened and scarcely at all expanded or reflexed except at the base. There is an excessively delicate parietal callus. The type measures, alt. 8, major diam. 16.5, lesser diam. 14 mm. ; diam. of umbilicus 2 mm. ; aperture 8 x 8 mm.

Largest specimen, alt. 11, major diam. 19 mm.

Smallest adult, alt. 7, major diam. 15 mm.

Type: Cat. No. 3733 of the writer's collection. A paratype is Cat. No. 117086 of the Academy of Natural Sciences of Philadelphia, and another is in the collection of George Willett.

Type Locality: Roosevelt, Gila County, Arizona; in rock slides on north slopes, 2200 ft. altitude. 31 specimens examined, taken by Mr. George Willett, December 15, 1914, and November 1916.

Remarks: Although the shell characters of this modest species offer no very striking peculiarities, I have been unable to identify it with any of the sixty or so described members of the genus. There is apparently no end to the Arizonan Sonorellas. As compared with the other species of which I have seen specimens, *S. rooseveltiana* seems more than usually thin and fragile. The general porportions of the shell, as the spire, aperture, and so on, are quite variable.

Some of Mr. Willett's shells have found their way into other collections as *S. coloradoensis* Stearns, from the figures a quite different species.

Redlands, California.

THE DISTINCTIVE CHARACTERS OF LAMPSILIS MINOR AND L. VILLOSA.

BY T. VAN HYNING.

In sending out specimens of the *Unionidae* of Florida from the Florida State Museum, we have stated of *Lampsilis villosa* B. H. Wright, and *Lampsilis minor* Lea, that it was impossible to differentiate with certainty all of the adult specimens; this

being due to the eroded umbones, but with young specimens showing umbonal sculpture, it was an easy matter. Simpson says in his Descriptive Catalogue for both species, that the umbonal sculpture was not seen; hence no description. This museum has numerous specimens of young and adult of both species recently collected, and the young show the umbonal sculpture of both species to be composed of about four coarse ridges; in *minor* they are circular and in *villosa* V-shaped looped.

Mr. Frierson, in a letter of November 27, '16, writes that he has discovered how to differentiate the adults of these two species. He calls attention to an additional small muscle scar (cicatricula?) at the upper end of the anterior muscle scar (cicatrix) in *minor*.

I have just found time to go over the specimens in this museum and open them up, and separate them according to Mr. Frierson's discovery, and I am now prepared to give some additional information. In the majority of specimens a glass is required to see the small scar referred to, and then in the majority of specimens the small scar, instead of being separate, is but an extension of the larger one, which makes it still harder to determine. Simpson says, of *minor*, "anterior scars *deep*," and of *villosa* "muscle scars *scarcely impressed*." In opening a shell, the *deep* scar in *minor* is at once noticeable from the *shallow* one of *villosa*. *Minor* is a heavier, wider, and shorter shell than *villosa*, and the anterior distance from the umbo is shorter in *minor*.

Florida State Museum.

NOTES ON REPRODUCTION AND GROWTH IN CERTAIN VIVIPAROUS MUSSELS OF THE FAMILY SPHAERIIDAE.

BY RALPH J. GILMORE.

The present study was undertaken in an effort to determine the nature of the reproductive process in certain common forms of the family *Sphaeriidae*. For a long time incubation of the young has been known to occur in European forms, but no investigation has been made of related forms from America.

Historical. Jacobsen (1828) noted the fact that embryos of Cyclas develop in sacs. He observes that "each ovary is composed of a number of small cylindrical sacs or capsules. When impregnated, these sacs increase in bulk and gradually protrude from the abdomen. By this protrusion they are introduced into the gill cavity but still retain connection with the interior membrane of the ovary. These capsules contain the eggs and the young are developed in them. Each one contains but one egg or young one. As soon as the young has reached a certain size, the capsule bursts and the young is ejected into the gill cavity. We find in the gill cavity at one and the same time, capsules and young both large and small." Apparently the only part of Jacobsen's observations which is correct, is the fact that the young develop in sacs. Later authors fail to confirm his work. Oskar Schmidt (1854) investigated the anatomy of *Cyclas calyculata.* Franz Leidig (1855) studied the anatomy of *Cyclas cornea.* Stepanoff (1865) was the first to point out the brood pouch of Cyclas in its true relation. His observations were confirmed in 1885 by Ziegler. However, the work of both of these men was directed mainly toward segmentation and development of the embryo and their observations on the brood pouch were mere casual notes. In one of his plates Ziegler shows a diagrammatic figure including a small portion of a brood pouch. De Bruyne (1898) in a work on phagocytosis figures a brood pouch. Poyarkoff (1910) published a preliminary note on the incubation of embryos of Cyclas. This was followed in 1911 by a paper on the same form by Schereschewsky. Both of these authors gave considerable attention to the cellular structure of the pouch, its origin and function. The only work that has been published on American forms is that of Drew, who in 1894 described the anatomy of *Sphaerium sulcatum.*

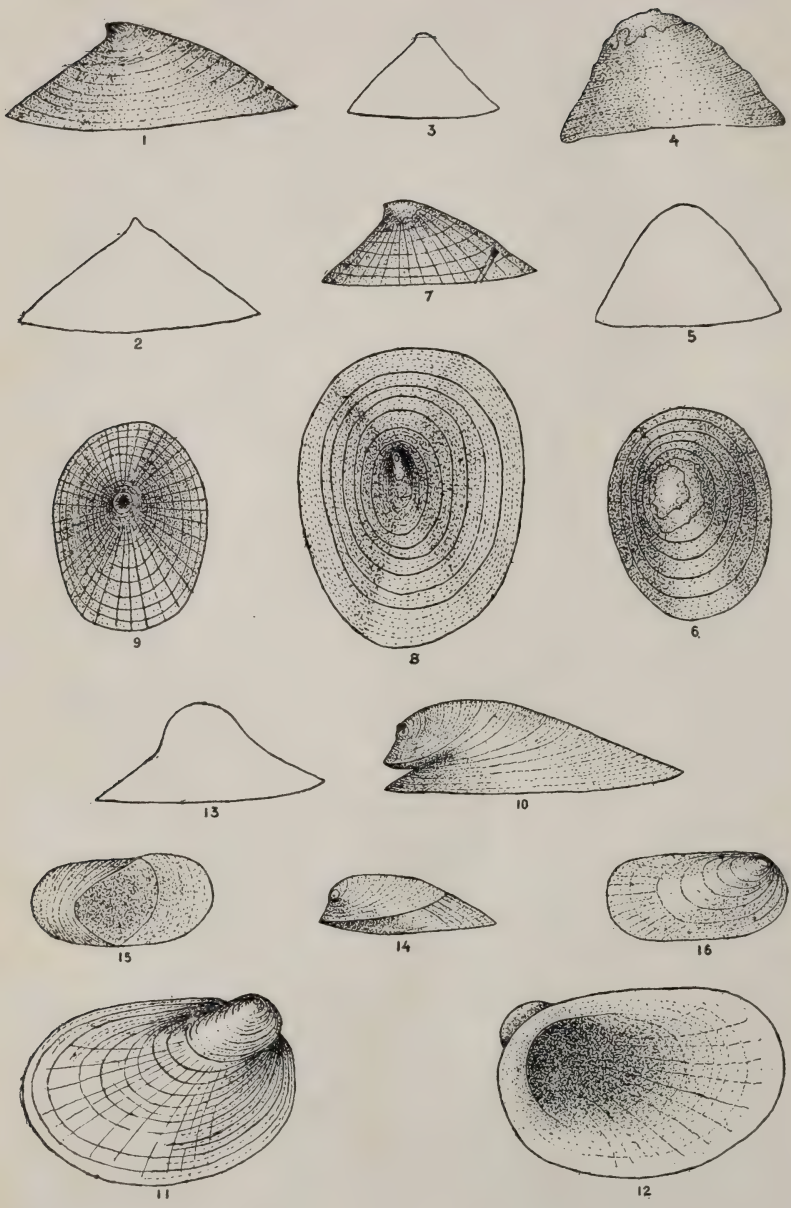
Material. The material for this work was collected during the summer and fall of 1913, from ponds and streams in the neighborhood of Ithaca, N. Y. Two forms were observed, *Calyculina truncata* and *Sphaerium simile.*

Calyculina truncata is one of the smallest of the *Sphaeriidae.* It averages about eight millimeters long, and seven high. The shell is very fragile, rhombic ovate, the posterior part very

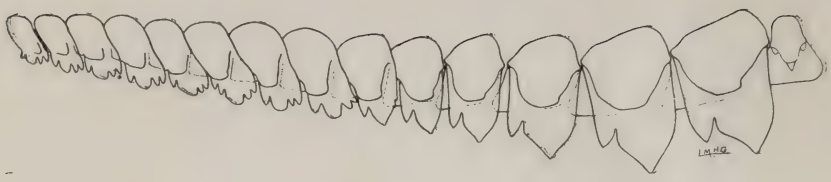
squarely cut off, the anterior broadly rounded. The surface is smooth and shining with very fine lines of growth. The color is light yellowish green or greenish horn. It occurs in clear fresh-water ponds or the sheltered parts of rivers, usually embedded in soft sticky mud, the siphons protruding just above the surface. Very often it may be seen climbing about on submerged vegetation. The seasons of greatest apparent abundance are the spring and early summer months. It quite frequently occurs in ponds which are dry throughout the greater part of the year.

Sphaerium simile is one of the largest species of the family. An adult specimen may be eighteen millimeters long and thirteen millimeters high. The shell is rather solid, almost equilateral, transversely oval (Fig. 10), the anterior and posterior margins almost equal. The surface is shining, pale green, with coarse growth-lines in young specimens but in older ones it is dull, dark brown to black with only those growth-lines evident which mark the ends of growth periods. It prefers clear, cold streams but may be found in quiet pools of rivers and lakes. It buries itself in soft mud or debris usually an inch or more below the surface. It communicates with the water above through a small hole in the mud. I have no record of this form occurring in places which are not well supplied with water throughout the year.

Methods. During the early part of the work, expanded animals were fixed in hot water or hot mercuric chloride. This method had one great advantage, in that it allowed very litte contraction of organs. But for cell structure the following was found to be better. The animals were prevented from completely closing the shell by a small piece of wood inserted between the valves. In this condition they were placed in cold saturated mercuric chloride with two to three percent of glacial acetic acid. They were kept in the fixer for twenty-four hours. The acidity of the fixer removed nearly all of the calcium salts of the shell. The remainder was removed by one half to one percent of hydrochloric acid in sixty-seven percent alcohol. The entire animal was imbedded in paraffin. Serial sections were cut from six to ten microns in thickness. Delafield's



WALKER: ANCYLIDÆ



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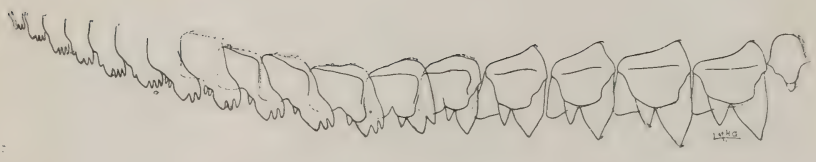
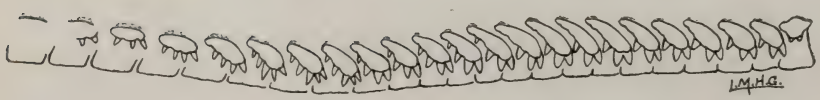
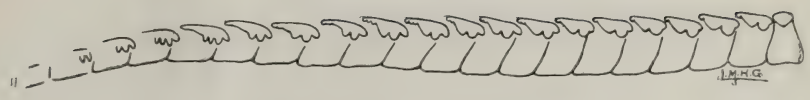


2. LANX KLAMATHENSIS HAN.

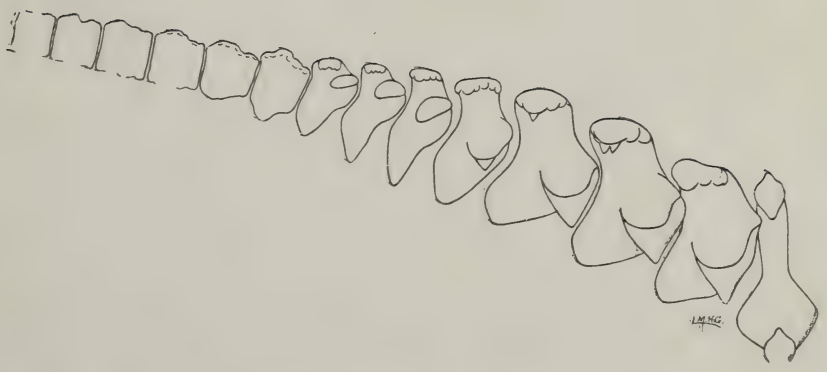
3. FERRISSIA RIVULARIS (SAY).



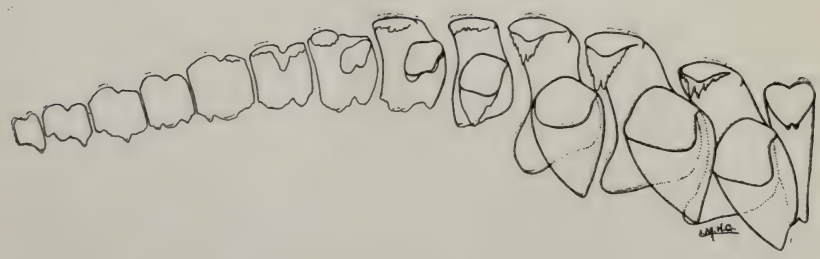
4. FERRISSIA (LÆVAPEX) DIAPHANUS (HALD.).



1. GUNDLACHIA HINKLEYI WALKER.



2. RHODACMEA FILOSA (CON.).



3. RHODACMEA RHODACME WALKER.

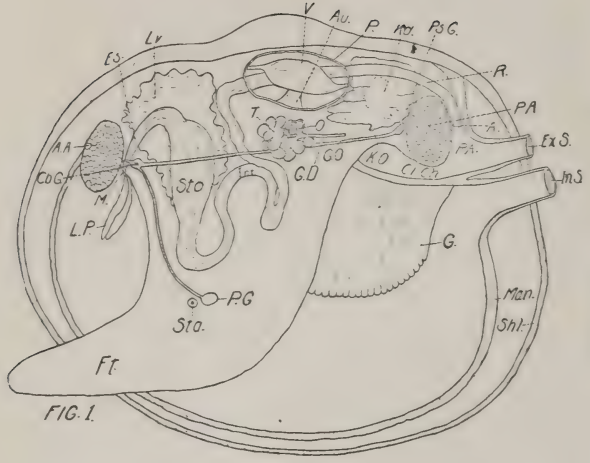


FIG. 1.

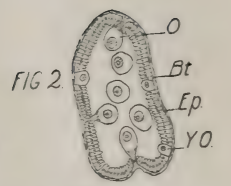


FIG. 2.

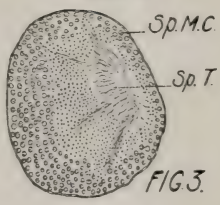


FIG. 3.

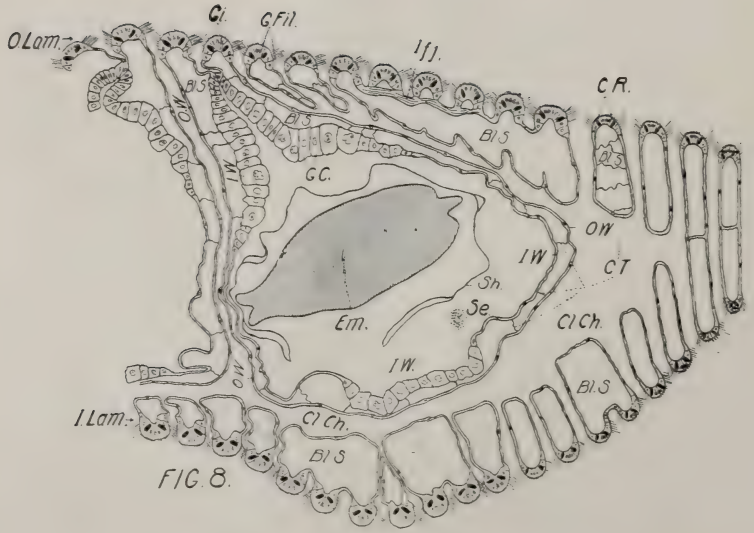


FIG. 8.

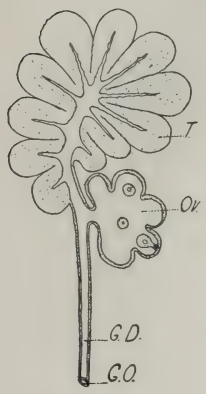


FIG. 4.

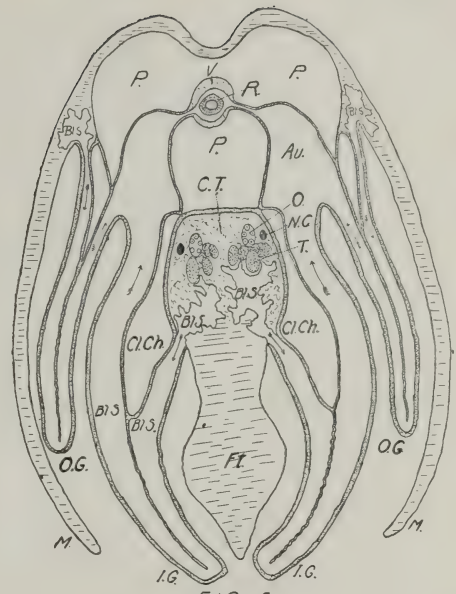


FIG. 5.

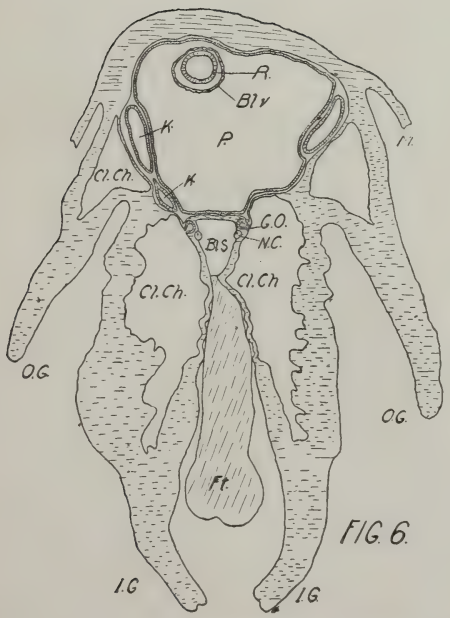


FIG. 6.

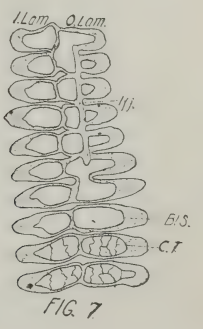


FIG. 7

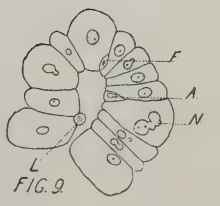


FIG. 9.

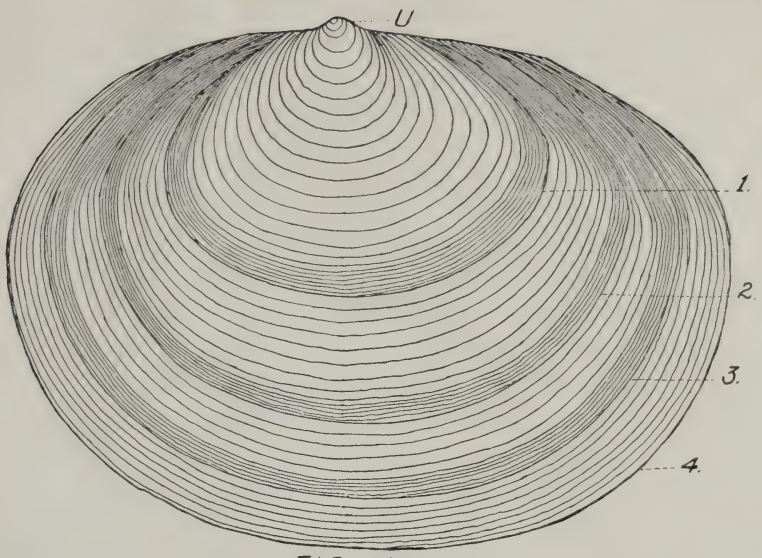


FIG. 10.

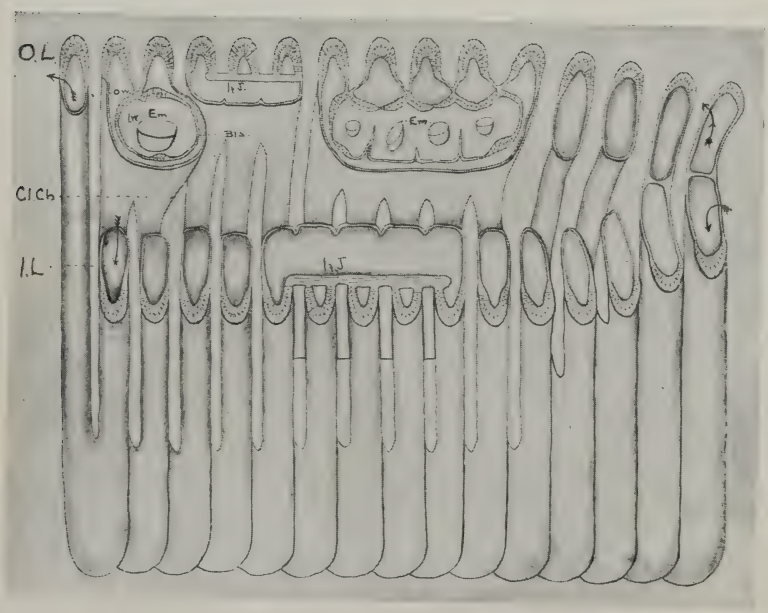


FIG. 11

GILMORE: REPRODUCTION OF SPHÆRIIDÆ

Haematoxylin and orange G. in ninety-five percent alcohol were used as stains.

In order to establish the relation of the brood pouch to the gill filaments and water spaces a wax model of parts of a gill was constructed from drawings made on an Edinger machine.

Reproductive Organs. The animal is hermaphroditic. The reproductive organs are situated beneath the pericardium and behind the stomach (Figs 1, 2, 3, 4). They consist of a pair of racemose glands, the anterior part of which produce sperm and the posterior eggs. A common genital duct continues backward, opening into the cloacal chamber of the inner gill near the opening of the kidney.

Plate V, Fig. 2, represents the essential parts of an egg follicle. Each follicle is lined with a single layered epithelium supported by a very heavy basement membrane. Eggs develop by the enlargement of certain cells of the lining epithelium. When a developing egg has grown to four or five times the size of the neighboring cells it is pushed out of its position by a pedestal-like growth of the basement membrane. Thus projected into the lumen of the follicle, it continues to develop until mature, when it drops off.

The sperm-producing follicles (Fig. 3) are irregularly spherical and arranged about their common duct like the parts of a raspberry. Each follicle is made up of a mass of sperm mother cells about its outer part and either fully formed or young sperm cells near the center. The center is hollow and communicates with the common sperm duct. This duct (Pl. V, Fig. 4) extends a short distance backward where it receives the product of the egg follicle, continuing from that point to the exterior as a common genital duct.

Regarding maturation and fertilization Stepanoff (1865) observes, "When the egg has reached a certain size it separates more and more from the wall of the basement tissue until it at last becomes free, in the inner part of the follicle and later falls into the outlet of the sex glands. The separation is affected by the increase of the yolk mass and the resulting weight of the egg. Eggs thus fallen into the duct become surrounded by a mass of fully formed sperm, so that, without doubt, fertilization

occurs in this place." Schereschewsky says, "Fertilization takes place in the gill chamber." In the majority of the specimens of Calyculina and Sphaerium ripe sperm and eggs were found to occur in the same individual. None of the specimens had eggs in the genital duct.

Breeding Seasons. The breeding season probably continues through the greater part of the year. Observations on this point have been very meager. Animals taken in November and December of 1913 were found to contain, in newly formed brood pouches, eggs some of which were unsegmented and others in very early cleavage stages. Considerably over fifty adult specimens have been sectioned. All were found to contain young in several stages of development.

Gills. Before considering the structure of the brood pouch it will be necessary to look into the structure of the gills. The gills are four in number, an outer and an inner pair. The outer is much smaller than the inner and falls short anteriorly by about a fourth of its length. Each gill has two lamellae. The outer lamella of the outer gill is attached to the mantle; the inner lamella of the outer gill is attached to the outer lamella of the inner gill and the inner lamella of the inner gill is attached to the body. It is the outer lamella of the inner gill which contains the brood pouches.

The lamellae are made up of gill filaments (Figs. 7, 8, and 11). A typical filament may be compared to a rubber tube sharply bent on itself to form a letter Y. Each filament of one lamella is therefore continuous with one of the other lamellae. The open part of the letter Y represents the cloacal chamber. All water which passes between the filaments finds its way into this chamber and from thence to the exterior. In the anterior and posterior parts of the gill the cloacal chamber is very much reduced (Figs. 8 and 11).

Each filament is a hollow tube which in frontal section appears as an irregular ellipse (Figs. 8 and 11). The outer part is made up of a single layer of heavy cells, strengthened by chitinous rods (Fig. 8). The inner part is a single layer of flattened cells forming a very thin membrane. The hollow

part of a filament is the blood space. This blood space may be crossed by an irregular loose network of web-like threads. These probably serve to prevent the membrane from collapsing. In the ventral part of the gill, except at the ventralmost part, the blood spaces of the two lamellae are kept separate as is shown (Figs. 5, 7 and 11).

At irregular intervals adjacent filaments are joined by interfilamentary junctions (Figs. 7, 8 and 11). Small ribbon-like bands of fibrous chitin may join several filaments for a short space. These by holding the filaments together give definite shape to the lamellae which would otherwise be a tangle of tubes. Another type of junction (Fig. 8) is made by the direct fusion of the elements of two adjacent filaments. This is the more common form of junction in the dorsal part of the gill. At the most dorsal part the filaments lose their identity entirely and fuse to form large blood spaces.

Between the filaments are water spaces which communicate with the mantle chamber on the outside and the cloacal chamber on the inside. Water is kept flowing from the mantle chamber to the cloacal chamber and the excurrent siphon by cilia. The outer surface of the filaments is covered with short cilia, the sides have a narrow row of longer ones.

Circulation of the Blood. The most important function of the gills is the purification of the blood. Blood leaves the ventricle by two main arterial trunks, the one supplying the anterior and the other the posterior part of the body. These vessels end in blood spaces which have no definite wall. The spaces of the greater part of the body pour their blood into the inner lamella of the inner gill (Fig. 5). Passing first ventrally in this lamella, it turns at the bottom of the gill and comes upward through the outer lamella. In the dorsal part of this lamella the filaments fuse to form a large sinus which becomes the auricle and empties into the ventricle. The outer gill derives its supply of blood from the mantle and such parts of the body as are near by. Blood enters the outer lamella, crosses to the inner lamella and enters the heart by the same channel that carries blood from the inner gill. It should be noted that the brood pouches are admirably located. For they are bathed

by blood which has just left the alimentary tract and later received its supply of oxygen.

Brood Pouch. Fig. 8 represents a fully formed brood pouch as seen in frontal section. The pouch has two distinct walls, an outer and an inner. These are direct continuations of the heavier portions of adjacent gill filaments. The outer wall consists of a thin one-celled membrane made of flat expanded cells. This wall is, in every respect, similar to the membranous part of the gill filaments. The inner wall is also made up of a single layer of cells. A part of this wall is similar to the outer wall though the major portion is composed of very thick glandular cells. Between the outer and the inner walls is a blood space. This space is a modification of the spaces of the two filaments to which the two walls are attached (Fig. 11). Numerous web-like cross threads occur in the blood space. These are similar to those which are found in the spaces of typical filaments. They furnish another proof that the two walls are mere modifications of filaments. The brood pouch may contain but one embryo (as in Fig. 8) or it may enclose a number (as in Fig. 11). A pouch may involve two filaments and only two (as in Fig. 8) or it may be constructed from the parts of several. The inner wall of such a pouch is thrown into folds which divide it into communicating chambers. These folds probably represent the contributions of the several filaments.

Just how the pouch originates is still an open question. Stepanoff (1865) and Schereschewsky (1913) believe it to be a modification of gill filaments. In Calyculina and Sphaerium all the available evidence points to such an origin. The wax model shows the pouch to be a modification of ordinary filaments. The same filaments enter into the structure of the pouch throughout its extent.

Poyarkoff (1910) offers this theory for the origin of the pouch: "When the embryo comes into contact with the gill filaments, it is surrounded and enclosed by leucocytes. Later these arrange themselves in two layers forming the brood pouch." He considers "the incubation of embryos in Cyclas as a case of ectoparasitism accompanied by the formation of a follicle at least in part, perhaps altogether mesodermal." Schereschewsky

reviews Poyarkoff's work and can find no good evidence to substantiate it.

One fact may be significant to show that the glandular inner wall is not a structure which must be derived from other sources than filaments. In the dorsal part of the gills all of the filaments are fused to form a heavy-walled blood sinus. This wall is made up of cells which, in every respect, resemble those of the inner wall of the brood pouch.

Nutrition of the Embryo. Schereschewsky observes that the embryo in the brood pouch is bathed by a distinct fluid which contains many acidophile granules. This fluid is the secretion of the large gland cells of the inner wall of the pouch.

Poyarkoff has a different theory. He says, "there are large cells of the inner wall of the brood pouch which serve for the nutrition of the embryo. At a certain time they become detached and fall into the lumen of the pouch. Their cytoplasm becomes homogeneous and eosinophile. Their nuclei take a uniform stain. The chromatin granules become almost completely indistinct. The embryo swallows these large cells. I have found these large shells in the intestine of some embryos. Stepanoff (1865) and Ziegler (1885) have noted this mode of nutrition." Poyarkoff further observes that the cells which have thus fallen into the cavity are replaced by leucocytes. Figure 9 is a copy of one of his illustrations. Schereschewsky has reviewed these observations and can find no evidence to justify them. In Calyculina and Sphaerium I have found undoubted evidence of secretion in the brood pouch. I have found a few cells thrown out into the lumen of the pouch but have considered this a normal phenomenon to be expected among actively secreting cells. As to the cells supposed to have been eaten by the embryo, may these not have been parasites?

Sexual Maturity. Gross examination of the gills of Sphaerium revealed young so large that it was thought probable that these young might themselves be bearing embryos. Examination of microscopic sections proved that such a condition does not exist. The smallest specimen found to contain young was ten millimeters long. This is two millimeters longer than the

largest young one found within the brood pouch. Several nine-millimeter specimens were sectioned but none were found to contain young. Young six, seven, and eight millimeters long have sex organs fully formed. I have no sections of very small Calyculina. The young of this form within the parent's gills are in the same stages of development as to the sex organs, as those of Sphaerium.

In the table which follows are included the results of gross examination of a number of Sphaeria. This is incomplete, since it was not possible to determine the presence of any young under five tenths of a millimeter. The animals examined were taken during July, 1913.

Size Length in mm.	*Total Examined*	*Total Bearing young*	*Percentage Bearing Young*
7	3	0	0
8	12	0	0
9	27	0	0
10	21	0	0
11	30	0	0
12	45	0	0
13	30	2	6.6
14	40	10	25
15	47	22	46.8
16	64	51	80
17	64	53	83
18	14	14	100
19	4	4	100

Sphaerium Bearing Young over .5 mm. Long.

Size	*Number bearing young*	*Total of class*	*Per cent of class*
13	2	30	6.6
14	10	40	25.
15	22	47	46.8
16	51	64	80.
17	53	64	83.
18	14	14	100.
19	4	4	100.

SIZE OF YOUNG TAKEN FROM ABOVE SPHAERIUM BY GROSS DISSECTION.

Size	*Frequency*	*Per cent of whole*
.5	1	.04
1.	16	6.
1.5	6	2.
2.	37	14.
2.5	9	3.
3.	26	10.
3.5	3	1.
4.	28	10.
5.	37	14.
6.	41	15.
7.	55	20.
8.	8	3.

267 young from 400 adults taken haphazard.

The size of the young was found to be independent of the size of the parent. An eight-millimeter young is as likely to be in a fourteen-millimeter parent as in one of eighteen millimeters length. The majority of the above contained two young, one in each inner gill. A few contained four.

Similar data were taken from Calyculina which were killed in June 1913.

Length of Parent	*Total Examined*	*Length of young*	*Number of young*
7	1	1.5	7
6	1	1.	4
8	1	1.5	9
7	1	1.5	16
7	1	1.5	10
8	1	2.	5
7	1	5.	3

The great variation in the number of young is probably due to the fact that some had already emerged from the parent pouch. I have no records which include totals of young of all stages. In one specimen I was able to count twenty-four.

No method has been discovered for determining the age of young or the period of incubation. I am inclined to believe that young in Calyculina are carried for one year or more. In a pond which was under observation for a period of over a year, adults were found in April to contain fully formed young. This pond had been dry from July of the year preceding until it became filled by melting snow in March. It had no inlet or outlet and received no overflow floods from any nearby ponds or streams. The number of young produced is probably ten to twenty in Calyculina and two to four in Sphaerium. These figures are based on the fact that these species during early spring contain about the above numbers of young, which when removed from the mother are able to take care of themselves.

Age in Sphaerium. The distinctness of growth-areas or rings in Sphaerium led to the belief that age might be determined by correlating size and number of rings. The entire surface of the shell (Pl. VI, Fig. 10) is thrown into narrow parallel ridges which represent growth-lines. At the beginning of a season these lines are widely separated; at the end they are crowded very closely together. One of these areas constitute a growth ring. In many specimens the several rings are further marked by slight differences of color due to deposits on the shell. The rings are usually very distinct though there are many forms in which they are very faintly differentiated.

The following table includes results obtained by measuring *Sphaerium simile.*

Total rings	*Number examined*	*Range of size in mm.*	*Average size in mm.*
1	46	5–10	8.6
2	58	9–14	11.2
3	86	9–17	13.2
4	116	12–18	16.9
5	67	12–19	17
6	20	12–19	17
7	6	16–19	17
8	1	18	18

While the above results are not conclusive they are certainly not altogether negative. The following facts seem significant.

1. No individuals attain a length of over 19 mm.
2. No individuals show more than 8 rings.
3. The averages of each class show an increase in length of about 2 mm. per ring.
4. The range of size included within each class is from 5 to 7 mm. This seems to indicate either that growth is very irregular in different individuals or that the rings do not indicate seasons. The fact that many specimens have very indistinct lines may account for some of these discrepancies. If one ring represents a year, the average age of a large specimen would be four or five years.

Regarding growth in the *Unionidae* Isely (1913) draws the following conclusions.

1. Rate of growth is exceedingly variable.
2. The summer months are the growth months.
3. Lines of arrested growth may be called rest rings, the conspicuous ones being usually winter rest rings. Occasionally the rest rings may be two or more years apart; more often, however, several equally prominent rings may be formed in one year. Prominent rest rings are generally due to double prismatic and epidermal layers.

Notes on Ecology. So far as observed the food consists mainly of diatoms. Many forms occur in ponds which become dry during the summer, remaining in that condition until the following spring. In aquaria I have observed that Calyculina will burrow down to the water level. Isely reports forms of Unionidae which were turned up by a plow in perfect condition.

The above observations emphasise the fact that very little is known about the habits of the forms considered.

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EXPLANATION OF PLATES IV–VI.

Plate IV. Figure 1. A diagrammatic dissection of Calyculina.

M —Mouth
Lp —Labial palps
Es —Esophagus
Lv —Liver
Sto —Stomach
Int —Intestine
R —Rectum
A —Anus
Cb G —Cerebral ganglion
Ps G —Parieto-splanchnic ganglion
P G —Pedal ganglion
K O —Kidney opening
T —Sperm follicles
O —Egg follicles
G D —Genital duct
G O —Genital opening
A A —Anterior adductor muscle
P A —Posterior adductor muscle
Ft —Foot
Cl Ch—Cloacal chamber
Ex S —Excurrent siphon

Sta —Statocyst
V —Ventricle
Au —Auricle
Pl —Pericardium
Kd —Kidney
In S —Incurrent siphon
G —Gill
Man —Mantle
Shl —Shell

Figure 2. Cross section of egg-bearing follicle of Calyculina.

O —Egg
Bt —Basement membrane
Ep —Epithelium
Yo —Young egg

Figure 3. Cross section of sperm-bearing follicle.

Sp Mc—sperm mother cells.
Sp —sperm

Figure 8. Frontal section of inner gill of Calyculina showing brood pouch. Drawn with Edinger machine.

O L —Outer lamella
I L —Inner lamella
Ci —Cilia
G Fil—Gill filament
Bs —Blood space
I W —Inner wall of brood pouch
O W —Outer wall of brood pouch
Ct —Cross threads
Em —Embryo
Sh —Shell remains
Cl Ch —Cloacal chamber
Gc —Gland cells of inner wall.
Sec —Secretion

Plate V. Figure 4. Diagrammatic section of sex organs. *Calyculina.*

T —Sperm follicles
Or —Egg follicle
Gd —Genital duct
G O —Genital opening.

Figure 5. Diagrammatic cross section through the region of the reproductive organs. *Calyculina.*

Pp —Pericardium
V —Ventricle
Au —Auricle
Bs —Blood space
R —Rectum
I G —Inner Gill
O G —Outer Gill
M —Mantle
Ft —Foot
Cl Ch —Cloacal chamber
O —Egg follicle
T —Sperm follicles
Nc —Nerve cords
C T —Connective tissue

Figure 6. Diagrammatic cross section of Calyculina to show opening of genital ducts.

G O —Genital opening
N C —Nerve cord
Cl Ch —Cloacal chamber
I G —Inner gill
O G —Outer gill
Ft —Foot
P —Pericardium
K —Kidney
R —Rectum
Blv —Posterior aorta
M —Mantle

Figure 7. Frontal section of neutral part of inner gill, showing fusion of the two lamellae. *Calyculina.*

I L —Inner lamella
O L —Outer lamella
Bls —Blood space
Ifj —Interfilamentary junctions
Ct —Cross threads

Figure 9. Part of inner wall of the brood pouch of Cyclas. (Copied from Poyarkoff).

L —Leucocyte lodged at base of cells
F —Leucocyte just entering wall of pouch
A —Leucocyte beginning to divide
N —Polynucleate cell

Plate VI. Figure 10. Shell of Spaerium simile showing growth lines.

U —Umbo
1, 2, 3, 4, —Growth lines

Figure 11. Diagrammatic reconstruction of a portion of the inner gill of Calyculina, showing the relation of brood pouches to gill filaments.

I L —Inner lamella
O L —Outer lamella
Cl Ch —Cloacal chamber
If J —Interfilamentary junction
G F —Gill filament
Em —Embryo
I W —Inner wall of brood pouch
O W —Outer wall of brood pouch
Bls —Blood space

COLLECTING SHELLS IN A CORNER OF THE SIERRA NEVADA.

BY JAS. H. FERRISS.

Prospects along the southern border of Arizona in the summer of 1916 were a little warlike; thus myself and family, two of us, joined with Prof. E. E. Hand, zoological instructor at the Wendell Phillips High School, Chicago, in a vacation to California. The hikers of the Sierra Club were ready for their annual July tramp and we joined their ranks. At Bakersfield we dropped off for a day's collecting along the banks of the Kern river.

That night the club, 260 strong, was overtaken and no further opportunities for collecting were conveniently at hand until we arrived at the forks of the Tulle river the next evening. We left the railroad at Springville in Tulare county.

This conservation club of nearly 2,000 members, Jos. LeConte, jr., President, and Wm. H. Colby, Secretary, seems to feel it to be a part of their work to show the way to the California mountains, to make them accessible and popular, and in this until his death a couple of years ago, John Muir was their leader. The membership is principally Californians, San Francisco and Los Angeles predominating. Our own state was well represented in this outing, for there were sixteen of us from Chicago and Joliet.

These annual excursions show the way to good health, the big trees, the highest mountains and the great canyons and do much to make California attractive to the globe-trotter. We ascended the Kern river Canyon, climbed Kaweah Peak, Mt. Whitney and the Kearsarges, opened the Muir trail and crossed over the range down to Independence, Inyo county, in the Owen valley—a snowbank in camp every night but the last, when we needed it most.

It was a delightful journey with delightful people, and the rivers and snowbanks were crossed without accident. It was the seventeenth year under the Colby régime, and practice has made the arrangements so perfect there was no jar in the program. Next July we ascend the middle fork of Kings river.

After this month of collecting, fishing, music, opera and lectures with the Sierra Club we hit the trail for another month with H. D. Gill, one of our packers acquainted with every corner of the range. We gave other lakes and peaks of that vicinity a thorough combing, via Rae lake, down the south fork of the Kings river, returning by the Giant Forest, Mineral King, and Rattlesnake Gulch, and Volcano creek and the Cottonwood lakes, to have a better acquaintance with the golden trout, (*roosevelti*). I also dropped off at Las Vegas, Nevada, and picked up a few shells.

The opportunities for collecting with the Sierra Club were excellent. When the party moved it was but a ten-mile journey for the day. The packers with about 100 horses and mules carried our baggage, provisions and cooking-ranges. A dozen elderly people and the packers had riding horses, the rest of us men, women, boys and girls walked. There were five good cooks and several commissaries, and our only stunt in drudgery was to pick out a soft spot in the timber at evening, unroll the sleeping bag, and roll it up again at five in the morning. At the most attractive points camp was made for a day or two, or sometimes longer.

In this portion of the Sierras at least, the snails cling to the meadows and wet ground about the springs. We had no success in the rocks or timber. Strangers to the habits of California snails, much time was wasted in our efforts to catch them. A Sierra meadow is much the same as the eastern peatbog and though apparently dry in spots, appearances are deceiving. It is all wet collecting. Wood-fungi, Pisidiums, Physas and land shells were found under the same sticks and all apparently thriving in the wetness.

Nevada is more upon the plan of Arizona and Utah. Shells were found plentiful at timber line under stone and decaying vegetation. As to moisture and cover the Sierra Nevada is favorable to snail growth, travel, distribution. Simply, it seems one of those situations where the large snails had never been—never settled. The collections for the season were identified by Dr. H. A. Pilsbry and myself jointly as follows :

[All stations are within Tulare county, California except when otherwise noted.]

Epiphragmophora callistoderma n. sp. Kern River, 2 miles N. of Bakersfield, Tulare Co., Cal.

Oreohelix handi n. sp. Smaller and thinner than *O. hemphilli.* Charleston Mt., Lincoln Co., Nev. This and the preceding species will be described in the next number.

Epiphragmophora (*Helminthoglypta*) *tudiculata* (Binn.), var. Panther Creek, Giant Forest, Tulare Co. A single dead specimen of a small, compact race, not agree closely with any of the named forms of *tudiculata.*

Pupilla sonorana St., var. Charleston Mt., Lincoln Co., Nevada.

Gastrocopa pilsbryana St., same locality.

Vertigo modesta parietalis Anc., Rae Lake.

Vertigo modesta castanea St., Bubbs Creek Falls, mouth of Big Arroyo, Stas. 5, 6, 7 Funston Meadows, Woods Creek, Panther Creek and Ranger in Giant Forest, Onion Valley in Kearsarge Pass, Inyo Co.

Vallonia cyclophorella Anc., Inyo Mts., Inyo Co., Calif., Charleston Mt., Lincoln Co., Nev., mouth of Big Arroyo, Tulare Co.

Vallonia gracilicosta Reinh., First Kern Butt, Funston Meadows.

Agriolimax campestris (Binn.) var. *occidentalis* (Cooper), Spring Brook at Las Vegas, Nev.

Vitrina alaskana Dall, Bubbs Creek Falls, Funston Meadows, Little Kern Lake, First Kern Butte, Rae Lake, forks of Tulle River, Panther Creek, Woods Creek, Mouth of Big Arroyo, Waucoba Springs, Inyo county Calif., Onion Valley, Inyo county, Charleston Mts., Lincoln Co. Nev.

Euconulus fulvus (Drap.), Bubbs Creek Falls, Stas. 5, 6 and 7 Funston Meadows, Woods creek, mouth of Big Arroyo, forks of Tulle River, Waucoba Springs, Hills near Waucoba Springs and Onion Valley in Inyo Co., Calif., and Charleston Mt., Lincoln Co., Nev.

Euconulus chersinellus (Dall.), Forks of the Tulle River, First Kern Butte, Little Kern Lake, Bubbs Creek Falls.

Pyramidula cronkhitei (Newc.), Funston Meadows, Woods Creek, First Kern Butte, Little Kern Lake, mouth of Big Arroyo,

Bubbs Creek Falls, Summit Meadows, Ranger and Panther Creek in Giant Forest, Onion Valley, Inyo Co.

Pyramidula shimeki cockerelli Pils., Tyndall Creek, Tulare Co., Waucoba Springs, Inyo Co.

Punctum californicum Pils., Forks of Tulle River, Little Kern Lake, Bubbs Creek Falls, Onion Valley, Inyo Co.

Succinea stretchiana Bld., First Kern Butte, Stas. 6, 7 and 16 Funston Meadows, Summit Meadow, Giant Forest, Waucoba Springs, Inyo Co. and Charleston Mt., Nev.

The lot comprises a large variety of forms between *avara* and *oregonensis* as well as small specimens that agree with an authentic *S. stretchiana* received from Bland. The Succineas of this region need revision.

Succinea oregonensis Lea, Bakersfield, Big Arroyo and Woods Creek. Also Las Vegas, Lincoln Co., Nevada.

Succinea gabbi Tryon, Tank Springs, Mazuka Canyon, Inyo Co., California.

Physa virginea gabbi Tryon, Bakersfield, Cal., Las Vegas, Nev.

Planorbis traski Lea, (young) Bakersfield, Cal.

Pisidium roperi St., Funston Meadows, Summit Meadow, Onion Valley.

Pisidium rowelli St., Stas. 6 and 7 Funston Meadows, Siliman and Panther Creeks, and Onion Valley.

Pisidium insigne Gabb, First Kern Butte.

MRS. MARIA BALDRIDGE.

We have recently received notice of the death of Mrs. Maria Baldridge of Los Angeles, California, April 7th, in her 82nd year. Mrs. Baldridge was one of the enthusiastic collectors of the Los Angeles group, who up to an advanced age devoted her attention to the shells of California with much success, several additions to the fauna being due to her assiduity and now bear her name. She had an interesting if not large collection, and will be missed by her associates not only for her interest in conchology but for her kindly and cordial character.

W. H. Dall.

PUBLICATIONS RECEIVED.

Mollusca of Australian Antarctic Expedition, 1911–1914, Scientific Rept. Ser. C. Zoology and Botany, vol. iv, pt. 1, 1916. By C. Hedley. A valuable contribution to our knowledge of

the Antarctic Mollusca. The dredgings were made along the coast of Adelie Land in Commonwealth Bay and Davis Sea and off Shackleton's Ice-shelf. Collections were also made at Macquarie Island. Two new genera *Ovirissoa* and *Friginatica* and forty-one new species and two varieties are described. Illustrated by nine plates with excellent figures of the new species and many of the other species from that region.

Summary of the Mollusks of the Family Alectrionidae of the West Coast of America. By W. H. Dall. Proc. U. S. Nat. Mus. vol. 51, pages 575–579, 1917. Dr. Dall divides the old genus *Nassa*, (a name first applied by Bolten to what was later called *Iopas*) from a conchological standpoint pending anatomical researches, into two groups *Arcularia* with a heavy callus about the aperture and a hump on the back of the last whorl and *Alectrion* for the reticulate species with little or no callus, no hump, and simple or nearly simple outer lip. Eleven new species included in the genera *Ihos*, *Nassarina* and *Gouldia* are described.

Terebridae of the Japanese Empire. By Y. Hirase. The Hirase Museum 1917. Illustrated by 8 plates with 131 figures. Except for an introductory letter by Marshall R. Gaines the text is in Japanese, but with the excellent figures, explanation to plates and bibliography, the work can be readily used by Western students.

Descriptions of New West American Marine Mollusks and Notes on Previously Described Forms. By Paul Bartsch. Proc. U. S. Nat. Mus., vol. 52, pages 637–681, plates 42–47. May 1917. Fifty three new species are described, embraced in the following genera: *Pyramidella*, *Turbonilla*, *Odostomia*, *Cerithiopsis*, *Bittium* and *Alvania*. One new subgenus, *Ugartea*, is proposed, the type being *Turbonilla juani* Bartsch.

NOTES.

A Sinistral Ampullaria.—In his recent review of the genus *Lanistes*, (Proc. Mal. Soc. London, XII, p. 65), Sowerby re-

marks that the only sinistral *Ampullaria* of which he had heard was that described by Nevill as *A. globosa* subvar. *sinistrorsa*. A sinistral *A. conica* was noticed by Miss E. J. Letson in NAUTILUS XI, p. 33. Through the kindness of Mr. W. F. Webb of Rochester N. Y., I have lately received a fine sinistral specimen of *Ampullaria ampullacea* (L.). It is a fresh, beautifully colored example, wholly without erosion and measures 68 mm. in height by 59.5 mm. in diameter. It was collected at Manuquid, Sarsogon, Luzon.—BRYANT WALKER.

VALVATA TRICARINATA PERCONFUSA n. n.—I find that in 1897 Westerlund, (Ann. Mus. St. Petersb., p. 130), described a Siberian species as *Valvata confusa*. I would therefore change the name of the variety of *V. tricarinata* that I described as var. *confusa*, in 1902 (NAUT. XV, p. 124), to var. *perconfusa*.

THE PONSONBY COLLECTION has been obtained by Dr. Bryant Walker. It contains 7,500 named species and varieties, represented by 12,500 lots. Mr. Fulton, who inventoried it, says: "probably the finest and most complete series of Helicoids ever collected by one individual."

AN ARBOREAL POLYGYRA.—At the beginning of April, taking advantage of the short spring vacation, Mrs. Cockerell went to the Brownsville region of Texas in search of bees and flowers. The bees collected include four new species and a subspecies, and two species new to the U. S. Incidentally, snails were obtained, and from San Benito come *Praticolella berlandieriana*, *Polygyra texasiana*, etc. The specimens of *P. texasiana* are mostly dead shells and of the ordinary form and size, but in the epiphytic Tillandsias on the trees occured a peculiar small variety, with max. diam. 7.3 to 8 mm.; pale brown color, strongly ribbed above, striate beneath. I opened the base of one, and there is no trace of a columellar tubercle such as occurs in *P. mooreana*. This small arboreal race may be called *P. texasiana tillandsiæ*, nov. Type no. 116250 A. N. S.

T. D. A. COCKERELL.

WASHINGTON MEETING, 1914

Bryant Walker Geo. H. Clapp T. H. Aldrich John B. Henderson
H. A. Pilsbry Wm. H. Dall Paul Bartsch

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NOTES ON THE VARIATION OF ISCHNOCHITON CONSPICUUS CPR.

BY E. P. CHACE.

To the naturalist the study of variation and environment and their relation to each other is always interesting and to the conchologist who studies his shells in their natural surroundings as well as in the cabinet many things are revealed. It is not, often, however, that variation in form may be so easily traced to qualities of environment as in the following instance.

Ischnochiton conspicuus, Cpr. is common at San Pedro and is usually found on the under side of rocks in sandy tidepools. In this situation they grow quite regularly, showing but slight variation in form. They are active fellows and evidently sensitive to light; for if the rocks to which they are clinging are turned over, they soon glide away, always taking the shortest route to the under side of the rock.

While cleaning a lot of this species taken at San Pedro last fall two specimens were noticed which differed so widely from the others that they might easily have been mistaken for another species. They were much wider and lower-arched than the typical form and the posterior corners of the valves were rounded off, making the lateral areas very narrow.

Hoping to find more specimens of this odd form, a trip to Point Firmen was devoted wholly to the collection of chitons, with interesting results. The usual species were found in the tidepools including numerous specimens of *Ischnochiton conspicuus* of the ordinary form. Ledges of soft rock beyond the

tidepools contained many old pholad holes and in these were found the form for which I was searching. Twenty specimens of various sizes were collected from as many pholad holes. In the larger specimens the foot had become so greatly enlarged to fit the concave bottoms of the holes that it was impossible for them to curl up in the usual manner. Some of these specimens were so badly eroded by the sand and gravel which wash in and out of the holes that the anterior valve was reduced to two thirds of its normal height.

In color pattern, sculpture, and mantle characters these specimens were identical with those from the tidepools, and, as will be seen by referring to the table of measurements, the smaller specimens approach quite closely to the proportions of the typical or tidepool forms.

Typical or Tidepool Forms. (Lot 1)				Specimens From Pholad Holes. (Lot 2)			
Lon.	*Lat.*	*Index.*	*Div.*	*Lon.*	*Lat.*	*Index.*	*Div.*
99	35	2.52	130°	65	33	1.97	135°
83	33	2.51	130°	63	32	1.97	155°
83	30	2.76	125°	62	27	2.29	140°
62	22	2.80	125°	60	30	2.00	130°
59	23	2.56	130°	56	29	1.93	130°
38	14	2.71	130°	42	17	2.47	130°

In brief, Lot 1 shows an angle of divergence constant at 125° to 130°, where Lot 2 shows an angle varying from 130° to 155°, and a proportion of length to width 2.51 to 2.80 as against a proportion ranging from 2.47 to 1.93.

The noticeable differences to the eye are first, the narrow and sharply raised lateral areas, and second, the shape of the posterior edge of the median valves. In the tidepool specimens the posterior or exposed edge of each valve is a straight line, while in specimens from the pholad holes this line becomes a double convex curve, the most posterior portion of the valves being about midway between the beaks and the girdle.

These differences seem to be explained by the following facts. In collecting, the tidepool specimens are usually found on the under side of large rocks and well back from the edge. This situs protects them from the light which they evidently find

objectionable, but it makes necessary a nightly journey of about two feet to the nearest growth of algae on which they feed. This activity stretches the girdle downward from the edges of the valves and permits a free play of all the valves so that the mantle deposits its shelly secretions according to the normal habit of the species. The specimens living in the pholad holes, however, apparently never leave them as they are frequently found feeding on the fucus which overhangs them. It protects them from the light, so they have no occasion to move about, and the sand which is washed down into these burrows would make re-entrance almost impossible. A series of these specimens shows a gradual change of form. The young specimens are very similar to young specimens from the tidepools, but as they increase in size they become crowded so that the valves press against each other, especially at the posterior end where the valves are bent back across the bottom of the hole. This crowding of the valves upon each other and the crowding of the girdle against the outer edges of the valves so displaces portions of the mantle as to cause the changes noted above.

Several specimens from each situs were disjointed and a study of the individual valves showed that those from pholad-hole specimens were thicker and had shorter sutural plates and a wider sinus, this last being especially noticeable in the valves from the posterior end. Apparently this change in the sinus is the result of the broadening of the connecting ligaments due to compression by the crowding valves.

A count of the insertion plates of these disjointed specimens was made and considerable variation noticed. So much, in fact, that more specimens were pulled apart for the express purpose of counting these plates. Representative counts were as follows: 9 slits on the anterior valve, 2–3 on the median valves, and 10 on the posterior. Others show 12, 2–3, 8; 11, 2–3; 14, 3–4, 11. Absolutely no difference in this character could be found between specimens from the tidepools and those from the pholad holes.

On page 64 of vol. xiv of the Manual of Conchology, Dr. Pilsbry says, "Carpenter has given a varietal name to a broad, worn specimen which he thus describes:

"Var. *solidus*. Very solid, wide, ashen; inside whitish, the posterior valve with 10, central valve 2–3, anterior valve 12 slits. Length 72, breadth 40, divergence 130°. Carpenteria, near Sta. Barbara, Cal. This is scarcely more than an individual variation. The mantle (girdle) is normal. The sculpture is worn away except at the edge. It has evidently lived in a very exposed situation."

From this description and the figure which he gives of the valves it would seem that this is the same form as my specimens from the pholad holes. I fully agree with Dr. Pilsbry that it is hardly worthy of varietal rank. It is, however, too distinct in appearance to be labeled simply *Ischnochiton conspicuus*, Cpr., and I have therefore marked these specimens from the pholad holes *I. conspicuus*, Cpr., *form solida*, Cpr., using the term *form* as advocated by Dr. Cockerell, "to designate variations plainly due to environment." [1]

LAMPSILIS VENTRICOSA COHONGORONTA IN THE POTOMAC RIVER.

BY WILLIAM A. MARSHALL.

In 1912 Dr. A. E. Ortmann recorded [2] finding in the Potomac River a variety of *Lampsilis ventricosa* [3] to which he gave the name *cohongoronta*. His records were:

September 4, 1909. Potomac River, Hancock, Washington, Co., Md. (about two dozen).

May 9, 1911. South Branch, Potomac River, Southbranch, Hampshire Co., W. Va. (about a dozen).

August 16, 1911. Shenandoah River, Harper's Ferry, Jefferson Co., W. Va. (a single male, below medium size).

May 6, 1912. South Branch, Potomac River, Romney, Hampshire Co., W. Va. (about a dozen).

Dr. Ortmann remarked "It is probable that this species will

[1] NAUTILUS, vol. xx, pp. 58–60.

[2] NAUTILUS, xxvi, pp. 51–55, 1912.

[3] In a later work Ortmann classifies both *ventricosa* and *cohongoronta* as varieties of *ovata* Say.

turn up elsewhere in the Potomac. The localities known at present are all to the west of the Blue Ridge Mountain, that is to say, within the Great Alleghany Valley and the Alleghany Mountains."

Perhaps the above prediction has been realized in a specimen found at Great Falls, Md., by Mr. Manly D. Barber of Knoxville, Tennessee, in Sept. 1915. At that time Mr. Barber brought to the National Museum a basketful of naiades which he had collected the same day at Great Falls, about 18 miles above Washington. Among the shells, which were mostly dead ones, was a specimen of *cohongoronta*, dead, but in a fine state of preservation and with the periostracum nearly unblemished except for the usual erosion at the beaks. Its appearance indicated that it had been recently alive and that its home had been in the immediate vicinity of the place in which it was found. Had it been washed down from Harper's Ferry, some 50 or more miles above Great Falls it probably would have shown ill effects from so long a journey.

When found the two valves were separated, but so accurately do they fit together that it is evident they belong to the same individual. The fact that the valves were separated and yet were found near each other is additional (though not conclusive) evidence that they had not been transported any great distance by currents. At any rate this is the first recorded finding of the species in the Potomac River so far south as Great Falls.

The specimen is rather a small one. It measures, length 71 mm.; height 47 mm.; diameter 28 mm. It is in the collection of the U. S. National Museum, catalogue number 273834.

COLLECTING DAYS ABOUT THE NAVAL STATION, GUANTANAMO BAY, CUBA.

BY JOHN B. HENDERSON.

In March last, while waiting for a boat to take us to Haiti, Dr. Bartsch and I spent nearly three weeks at the U. S. Naval Station at the entrance to Guantanamo Bay. We employed our

time in exploring the country about and subjecting it to a high degree of intensive collecting. In this eastern corner of Cuba the coastal strip of some ten miles in width is a semi-arid region with a complex of mountains that are either quite bare of trees or, at most, covered with a scrub forest and low-growing spiny shrubs, with, here and there, a wealth of cacti that almost suggests Lower California. The rock foundation of all this region,—barring some shore strips of very recently elevated coral, is everywhere composed of about everything in the line of rocks except limestone. This is a condition that in the Antilles usually spells disappointment and failure to the snail hunter. North of the big bay and then across several miles of low flat country, just where the foothills of the sierras begin, lies the city of Guantanamo, interesting to us as the home of Charles Ramsden, the naturalist. Just north of Guantanamo is a great rampart of high limestone mountains which beckon most alluringly to the collector. Sections of this rampart, somewhat arbitrarily marked off, are the "Monte Verde," the "Monte Toro" and the "Monte Libano" of classic fame in Cuban Natural History.

In company with Ramsden we spent a wonderful day on nearby Monte Libano but a revolution that was then devastating the province and filling the land with incendiaries and bandits drove us out of this richer field and obliged us to confine our attentions thereafter to the arid country lying within the safer limits of the Naval Station,—some fifty square miles upon which Uncle Sam holds a long lease.

It seems to be a natural law that arid or desert lands support but few species of snails, but that these few species exist in great numbers and that they take on a very considerable range of variation. All this is perfectly true of this region. We were constantly amazed by the great number of specimens to be found; and each day of exploration in some new valley or over some range of hills added even greater figures of abundance to our already astonishing records.

The "prevailing" snail of this region is *Cepolis ovumreguli* Lea. Its shell is very suggestive of the true helix of Spain or Algeria of the *lactea* group. The variation is exceedingly great

in color, size and shape, and it would make a dozen excellent species if the intermediates were left out of account. Those living near the coast and among the cacti of the most arid parts of the district are of whiter and more dull color, are more banded and show a decided tendency to abnormalities, especially about the apertures. Specimens from further inland are more polished and shining, even as though varnished, and are much more given to a dotted or fly-specked type of ornamentation than to bands. A fence-post or a dead tree-limb with a hundred specimens closely assembled in aestivation was no unusual sight. We learned finally to pay no attention to them. Upon the low bushes in certain localities the lovely little *Cepolis lucipeta* Poey cling like berries. These are the largest and finest of the species I have ever seen. The range of color variation in this delightful little snail is also very great, but the colors never blaze out in the vivid flash of the Polymitas. The blues and purples and chestnut browns are subdued but very rich and splendid. One very noticeable color form is the subsp. *velasqueziana* of Poey where the many broken bands of the type coalesce into two broad bluish-black zones of solid color.

As nearly all the vegetation of this dry region bears thorns we did not at first discover that many of these thorns were in reality Macrocerami. When we did find this out we could see nothing else. Bartsch and I finally agreed, and shook hands upon it, that we would gather no more of them, and a stiff penalty was placed upon any violation of the compact. Two hundred and more from one bush is an earlier record before we really got started. This is the *Macroceramus festus* (Gundl.) Pfr., blue and yellow and buff in color. Another arboreal snail of this section is *Polymita versicolor* Born and it is probably very abundant in places although we never saw more than fifteen or twenty on any one tree. This is to me the least attractive species of that wonderful genus of richly painted snails. The brilliant yellow and pink are too primitive and the two colors do not seem to harmonize very well. It always impresses me as an experimental species that was laid aside in nature's laboratory as not wholly a success.

There were some ground snails too, but to secure living ones

required much grubbing up of tufts of tall grass and shaking out their roots, like digging up miniature potatoes. These are the *Annularia putris* (Gundl.) Pfr. and the *Chondropoma marginalbum* Gundl.) P fr., the latter apparently quite rare. There are no minute things beyond some few *Thysanophora inaguensis* Weinland.

Some days we spent gathering marines on the little pebbly beaches hidden far down under the lofty cliffs that mark this rugged shore line, and we obtained some unusual species washed up from the exceedingly narrow island-shelf; blue water is but a few hundred yards out. Among these are some *Conus cedonulli* Lam. Beach collecting is, however, an aggravation; and too much of it becomes a misdemeanor in the collector's ethical code, for it obliges an acceptance of something short of the best.

AMNICOLIDÆ FROM ONEIDA LAKE, N. Y.

BY HENRY A. PILSBRY.

The New York College of Forestry, under the direction of Professor Hugh P. Baker, is carrying on a biological survey of Oneida Lake and has issued an interesting bulletin[1] upon the relations of mollusks to fish, by Frank C. Baker. Some *Amnicolidæ* obtained during this work, and subsequent to the preparation of the bulletin were submitted to the writer. The collection proves to be of considerable interest, including some species not before noticed.

AMNICOLA BAKERIANA, n. sp.

The shell is umbilicate, turrited-conic, thin, whitish-corneous, somewhat translucent, with unevenly developed striation, dis-

[1] The relations of mollusks to fish in Oneida Lake. By Frank Collins Baker. Technical Publication No. 4, New York State College of Forestry at Syracuse University. Pp. 366. Syracuse, N. Y., 1916. We are informed that it may be obtained free by those interested in the study of Mollusca by applying to the dean of the college, Dr. Hugh P. Baker.

tinct, and close in places, weaker and sparse elsewhere. The summit is decidedly obtuse, as in *A. limosa*, the first whorl being nearly planorboid; subsequent whorls are evenly, strongly convex. The aperture is very shortly ovate, almost round, its length contained almost $2\frac{1}{2}$ times in that of the shell. Peristome thin, in contrast with the preceding whorl for a short distance.

Length 4.3, diam. 2.7 mm. ; 5 whorls (type).

Length 3.75, diam. 2.3, length of aperture 1.35 mm.; $4\frac{2}{3}$ whorls.

Length 4.1, diam. 2.75, length of aperture 1.65 mm.; $4\frac{2}{3}$ whorls.

Oneida Lake; off Short Point in $8\frac{1}{2}$ ft., mud bottom. Lower South Bay, in 18 ft., on mud bottom.

This species resembles *A. limosa* in the conspicuously obtuse apex, but differs by the more elevated, turrited spire and the smaller calibre of the whorls, hence smaller aperture. It is also a weaker shell, with more whorls in specimens of the same length.

There is also an abundant smaller form, resembling the typical form in texture, apex and shape of the whorls, varying in form, but relatively broader than the type. There are some intermediate examples, but as Mr. Baker considers it desirable to have a designation for this form, it may be called *A. bakeriana* form *nimia*. The type measures: length 3, diam. 2.5, length of aperture 1.4 mm.; 4 whorls.

AMNICOLA CLARKEI, n. sp.

The shell is narrowly umbilicate, conic, a little obtuse at the apex, corneous, nearly smooth. The whorls are very convex, separated by a deep suture, the last whorl tubular. The apeture is distinctly oblique, almost circular, the upper end rounded, but a trifle more narrowly so than the base. It projects but little beyond the preceding whorl laterally. The peristome is thin, continuous, scarcely or barely in contact with the preceding whorl above.

Length 3.1, diam. 1.9, length aperture 1.1 mm.; 5 whorls (type).

Length 2.8, diam. 1.6, length aperture 0.85 mm.

Operculum having the spiral rather large, the nucleus being above the lower third.

This little species resembles *Lyogyrus* by its tubular whorls of small calibre. The whorls are more convex and increase less rapidly than in *Amnicola walkeriana*, which is also less slender. *A. schrockingeri* Ffld. has less deeply convex whorls, and the apex is more acute. *A. bakeriana* is much larger, with a more obtuse apex.

Found in Short Point Bay, Oneida Lake, near shore, in 3 feet of water, bottom of sand with algae; also in Lower South Bay, etc. Collected by Mr. F. C. Baker.

It is named for Dr. John M. Clarke, the distinguished Director of the Museum of the State of New York.

AMNICOLA ONEIDA, n. sp.

The shell is typically more slender than *A. lustrica*, turrited-conic, narrowly umbilicate, corneous, minutely striate. The apex is slightly obtuse, but the first whorl projects visibly, as in *lustrica*, whorls *very convex*, parted by a *deep suture*. The aperture is ovate, small, its length contained more than 3 times in that of the shell; upper extremity narrowly rounded. The peristome is continuous, thin, very briefly in contact with the preceding whorl above.

Length 4, diam. 2, length of aperture 1.25 mm.; 6 whorls.

Lower South Bay, Oneida Lake, N. Y., collected by F. C. Baker, 1916.

This species is typically narrower than *A. lustrica* Pils., with a smaller aperture and shorter whorls; but it is chiefly distinguished by the more convex whorls (deeper suture), and the rounded instead of angular posterior end of the aperture. In *Paludestrina nickliniana* the last whorl is much longer. Possibly it may be a subspecies of *lustrica*, yet it has so distinct an appearance that a special name seems desirable. There are also wider examples, which still differ from *lustrica* by the deeper suture and aperture.

NEW GENERA AND SPECIES OF CENTRAL AMERICAN NAIADES.

BY L. S. FRIERSON.

In 1893 Messrs Crosse and Fischer divided the Mexican Naiades into quite a number of sections, to which they assigned names. Almost simultaneously (in 1900) von Martens and C. T. Simpson, in treating the Central American Naiades, accepted some of these sections of Crosse and Fischer, raising them to generic or subgeneric rank. Because of paucity of material, considerable diversity of opinion concerning the specific identity of several species may be noted in the works of these authors. Furthermore, their work of classification being done independently and from different points of view, the same species was sometimes placed by them in different genera.

Thanks to the arduous labors of A. A. Hinkley, who has again and again enriched our cabinets with material and data from these tropical countries, we are enabled to offer the following suggestions concerning some of the genera of these shells, and also the description of an unpublished species.

NEPHRONAIAS. This genus has for its type the *Unio plicatulus*, Küster, a species identified by von Martens as belonging to the Lampsiline shells, as *aztecorum*. Mr. Simpson however believed it to be nearly allied to the *persulcatus*, a markedly Unioid shell. In this the writer follows Mr. Simpson.

The genus *Nephronaias* as constituted by Mr. Simpson embraces two quite distinct groups, divisible as follows.

Nephronaias (*s. s*) embraces *plicatulus*, *persulcatus*, *melleus*, *dysoni*, *ortmanni*, *ravistellus*, etc. Ample material of these two latter species show that they are anatomically very closely allied to *Elliptio*. There is no sexual difference of shape, and the gill is gravid in its whole length. *Nephronaias* differs from *Elliptio* in its sulcated disc, in its beak sculpturing, etc.

Included in *Nephronaias* by Simpson are, however, shells of a totally different type, such as *medellinus*, *gundlachi*, *sapotalensis*, etc. These latter are sexually dimorphic, smoother, more generally rayed, and the gravid uterus is of Lampsiline type.

The position of the dorsal scars within the beak cavities is

different, in the examples of the pseudo *Nephronaias* seen by the writer. *Nephronaias* (*s. s.*) posseses an (accessory ?) adductor scar attached to the frontal portion of the cardinal teeth, which is either absent or obsoletely marked in the second assemblage. For this latter group the writer, therefore, proposes to use the generic term of *Actinonaias* Crosse and Fischer, 1893, type *U. sapotalensis* Lea. The female of this species has been described by Dr. Ortmann (1912). *Actinonaias* embraces, besides the type, *medellinus*, *gundlachi*, (accepting Simpson's interpretation of this latter species), and others.

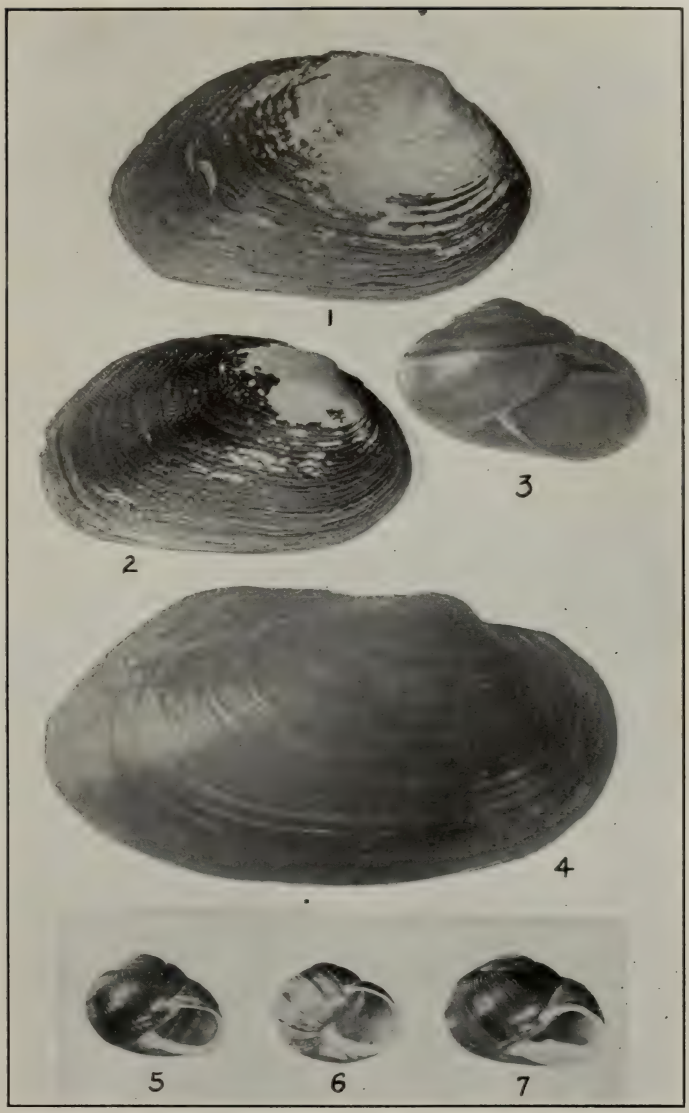
Psoronaias, Crosse and Fischer (1893). This group of remarkable shells, embracing *crocodilarum*, *psoricus*, *semigranosus*, etc., was provisionally treated by Simpson as a group of *Elliptio*, but their remarkable sculpturing, and the deap beak cavities of some of their species, led him to observe that it was possible that the group should, after all, be placed in *Quadrula*.

I follow von Martens, in giving generic rank as above to the group. The type is *Unio psoricus*. To this genus we are enabled to add a species hitherto undescribed, under the name of

Psoronaias kuxensis, n. sp., Pl. VII, figs. 1, 2.

Shell small, compressed, rough, brown, biangular. Length 50, height 30, diam. 17 mm.

Shell hyperbolically rounded before, the extreme frontal point below the centre. Dorsum slightly arched, descending behind the ligament to the widely biangular posterior ; the upper angle of which is midway the height, the lower angle very little above the base, which is nearly straight. The beaks are small, low, acute, approximate; and *apparently*, concentrically ridged. Epidermis dark brown (olivaceous and obsoletely rayed in the young), rough, the lines of growth numerous and well impressed. The discs are covered with fine pustulations, more pustular in front, biradially linear behind. The post ridge is low, but distinctly double, making the shell biangulate behind. The teeth are double in the left valve, single in the right. The cardinals are deeply sulcate and stout. Laterals slightly curved or nearly straight, separated by an interdentum. Nacre purple, beak cavities rather deep. Dorsal scars numerous,



1, 2 PSORONAIAS KUXENSIS FRIERSON.
3. EPIPHRAGMOPHORA CALLISTODERMA PILS. & FERR.
4. UNIO TETRALASMUS SAY.
5, 6. ZACHRYSIA RAMSDENI PILS.
7. Z. EMARGINATA PFR.

extending in a row from above the centre of the cavity down and forward upon the base of the cardinal teeth. Three well impressed muscle scars in front, two behind, the later almost confluent. Habitat, Kux Creek, Chama, Guatemala. Collected by Mr. A. A. Hinkley, Feb. 6, 1917. A few dead specimens were obtained on the bank of the Isaibha River (Chama) of which the Kux Creek is a tributary. Type in Academy Natural Sciences. Cotypes in collection of A. A. Hinkley, the author and U. S. N. Museum.

I place this species in *Psoronaias* Crosse and Fischer, type *U. psoricus*, because of its evident relationship to *crocodilarum*, and *distinctus*, differing mainly from the latter in size and degree of inflation, being much inferior in both respects to *distinctus*.

ON THE RATE OF GROWTH OF POND UNIOS.

BY L. S. FRIERSON.

During the latter part of March 1916, the writer, for the purpose of constructing a fish pond, excavated a barrow-pit near the bank of a small creek, about ten feet wide, and at the time nearly dry. The barrow-pit was perhaps one hundred feet long, fifty feet wide and three feet deep. Early in April, 1916, the pit became full of water, overflowing from the adjacent creek, and together with two subsequent overflows, supplemented with seepage from the newly constructed fish pond, the pit remained more or less full of water, until May 25, 1917, when it was drained by a ditch into the nearby creek. From the dried bottom of this pit some thirty Unios were picked up by the writer. Ten of these were *Unio tetralasmus* Say, and the rest were *T. texasensis* Lea. All the specimens were of remarkably uniform size and appearance. The *texasensis* being about one and a half inches, and the *tetralasmus* two and a half inches long. Exact dimensions of a *texasensis*: length 43, height 24, diam. 16 mm.; of *tetralasmus* 75, 40, and 25 mm.

Both of these species had attained puberty. A female *texasensis* has its gills fairly full of young glochidia. A *tetralasmus* had several (three or four) ovisacs with a few (remaining)

glochidia. In assigning an age to these shells it is quite sure that the *tetralasmus* discharges its glochidia in March and early April, so that when picked up on May 25, these shells were just about fourteen months old, from the date of discharge from their mother's gills.

In the case of the *texasensis* (which spawns somewhat later) it is possible that these were dropped by fish of which, at least six species) obtained access to the pit on May 7, 1916 (on which date an overflow occurred), thus making about thirteen months. At any rate the maximum age of either species is fourteen months from their mother's ovisacs. One of the *U. tetralasmus* is shown of natural size in Pl. VII, fig. 4.

Another observation concerning pond mussels might here prove of interest. A large pond was cut into two by a railroad enbankment, a culvert preserving the level and providing communication between the two. In the lower and larger pond a half-bushel of Yonkapin (*Nelumbium luteum*) seed was sown. It was six years before these seed germinated. These plants, during the summer, cover the entire surface of the pond with their broad peltate leaves. In this pond the writer planted a colony of a dozen *Anodonta grandis*. Several years after, taking advantage of extreme low water, the writer made a careful survey of these twin ponds, with the result that hundreds of Anodons could be found in the upper pond, but not a single one was found in the lower pond. Either the shade killed the young shells, or else the glochidia-laden fish avoided the shade of the lotus plants and congregated in the upper pond (there are no Nelumbii in the upper pond). Is not this avoidance of shade a reason for the paucity of unios in the tropics?

A NEW SOUTH AFRICAN NESOPUPA.

BY H. A. PILSBRY.

NESOPUPA FARQUHARI, n. sp.

Among Pupillidae sent by Mr. J. Farquhar there is a new species from Grahamstown which may be defined by comparison

with *Nesopupa griqualandica* (Melv. and Pons.).[1] The new form is ovate, of about the size of the other species, which it resembles in sculpture and in the lamellae of the parietal wall and columella. The two palatal plicae are subequal, the upper emerging to the lip, the lower one also long, reaching to the inner edge of the peristome. There is a very small nodule on the base of the columella. In *griqualandica* the lower palatal plica is short and very deeply immersed and there is a distinct though small basal plica within the base, in front of the lower palatal plica. In *griqualandica* there is a deep sulcus outside, over the upper palatal plica, and a flattening or short groove over the lower palatal; but in *farquhari* the sulcus is far less impressed except quite close to the lip. The color is reddish brown. Length 1.65, diam. 0.9 mm.

Mr. Burnup's figure 9, in Melvill and Ponsonby's Revision,[2] may perhaps represent this species, while their description in the same paper appears to comprise both *griqualandica* and *farquhari*, though chiefly relating to the former. Their pl. I, figs. 8 and 10 represent *griqualandica*. The new form is named in honor of one of the most successful South-African collectors. It will be figured in the Manual of Conchology.

A NEW GUNDLACHIA FROM GUATEMALA.

BY BRYANT WALKER.

GUNDLACHIA HINKLEYI, n. sp., Pl. I, figs. 10–16; Pl. III, fig. 1.

Shell subovate, being much wider posteriorly, the anterior margin rather shortly rounded, the right margin nearly rectilinear, but somewhat diverging anteriorly, the left margin obliquely expanded and broadly rounded, anterior margin wider and much more curved than the posterior; apex very excentric, depressed and decidedly turned toward the right side, bluntly rounded, smooth except for a few concentric wrinkles; color a very pale corneous, nearly pure white; lines of growth rather strong and

[1] *Pupa griqualandica* M. and P., 1893; the specimens used being from Pretoria.

[2] Ann. Mag. N. H. (8), i, p. 76, pl. i, 1908.

irregular; anterior slope with strong radial striae originating below the septate growth and extending to the anterior margin, similar striæ appear on the left lateral slope, but are scarcely, if at all, visible on the right slope; the septate portion of the shell is small in comparison with the adult expansion, it is narrow and the posterior portion covered by the septum is free from and projects over, but scarcely beyond, the posterior margin of the adult aperture; the first growth of the shell from the septate form is continued on the sides in a nearly direct continuation of the lateral slopes of the septate shell for some little distance, the anterior slope of this stage is also a continuation of the anterior slope of the septate stage but owing to the oblique position assumed by the septate shell is at first somewhat convex, as viewed laterally, later as the side slopes begin to expand, the anterior slope is continued in a nearly straight line to the margin; the left lateral slope of the adult shell below the secondary constriction is concave at first, becoming nearly straight toward the margin; the right lateral slope is less concave above and straighter and more oblique than the left; owing to the small size of the septum and consequent large aperture of the septate shell and the narrow first growth of the adult shell there is no distinct aperture to the septate portion visible in the adult shell from below, the whole interior of the adult shell appears to pass, practically unconstricted, directly into the septate portion; the posterior margin of the adult shell narrow and somewhat abruptly expanded and reflected.

Length 5.5; width 3.75; alt. 1.75 mm.

The septate shell is oblong, the sides being nearly parallel, but slightly expanding anteriorly, the right slightly convex and the left slightly concave; the posterior margin is regularly rounded; the anterior more broadly rounded; the apex depressed, bluntly rounded, excentric, reaching nearly to the right margin, smooth except for slight concentric wrinkles, lines of growth fine and regular; the anterior slope is slightly convex; the very short posterior slope below the projecting apex to the line of the septum is straight and oblique; the right lateral slope is steep and nearly straight, the left slope very convex; the septum is very short, being less than half of the length of

the septate shell, convex on its lower surface, the margin is very short, being less than half of the length of the septate shell, convex on its lower surface, the margin is very concave and on the right side, extends further forward than it does on left, there does not seem to be the distinct thickening of the margin so noticeable in other species; aperture much larger than in any other species yet described.

Length 2; width 1.5; alt. .75 mm.

Type (43455 Coll. Walker) from the Maya Farm, Quirigua, Guatemala, collected by A. A. Hinkley. Cotypes in the collection of Mr. Hinkley.

This fine species is the first from either Central or South America, of which both the septate and adult forms are known.

It differs from all other described species except *crepidulina* Guppy in the small size of the septum and the consequent difference in the position of the aperture of the septate stage in the adult shell. The septum in the specimen figured appears very like the incomplete septum in the North American species, but as the three adult specimens before me are exactly alike in the position of the septate shell, this would seem to be the normal condition in this species. The specimen figured, which is 3.25 mm. in length, has apparently slightly passed the septate stage and begun the growth of the constricted portion of the adult shell and shows the beginnings of the radial striæ.

With the Gundlachias was associated a species of *Lævapex*, very like the *excentricus* Morelet. Whether it has any closer relations with the *Gundlachia* remains to be determined as the radula has not yet been examined. While the general aspect of the two species, if such they be, is very similar, the *Lævapex* has a very much more acute apex than the *Gundlachia*.

As shown by the figure, the radula of this species is quite typical of the genus.

A LIST OF SHELLS FROM THE EAST COAST OF FLORIDA.

BY BRYANT WALKER.

The late Dr. Charles A. Davis, the well known peat-expert of the U. S. Bureau of Mines, in addition to his special acquire-

ments in geology and botany, was a good all-round zoologist and had a lively and unaffected interest in the work that any of his friends might be carrying on in that department. It was his kindly habit in his travels about the country to preserve any specimens that he came across that seemed to him likely to be of interest to any of his zoological friends. It will be remembered that the conchologists owe to him the rediscovery of the long lost *Planorbis multivolvis* Case, (NAUT., XXI, p. 16), and also the little *Lymnæa davisi* Walker, (NAUT. XXII, p. 17), which bears his name.

In the spring of 1911 Dr. Davis' professional duties took him to Florida and while there he collected quite a number of samples of "drift," which in due time came into my possession. Several of the localities represented in the collection, such as Maimi and St. Augustine, have already been reported upon by previous collectors and there seems to be no occasion to duplicate their work, but quite a number of the places visited by Dr. Davis have not been covered by any of the previous collectors in Florida and a record of the species found by him seems worthy of publication as a contribution to the distribution of the Mollusca along the east coast of the state.

I am indebted to Dr. George H. Clapp for the identification of the Gastrocoptas and Vertigos.

The list of localities and species represented in the collection is as follows:

MARSHES NEAR CHESTER SHOALS.

Euglandina rosea Fér.
Polygyra cereolus carpenteriana Bld.
Zonitoides minuscula (Binn.).
Zonitoides minuscula alachuana (Dall).
Vitrea dalliana ('Simpson' Pils.).
Pupoides modicus (Pfr.).
Gastrocopta rupicola (Say).
Gastrocopta pellucida hordeacella (Pils.).
Gastrocopta tappaniana (C. B. Ads.)?
Gastrocopta pentodon (Say).
Vertigo milium (Gld.).
Melampus coffeus (L.).
Detracia bulloides (Mont.).
Chrondropoma dentatum (Say.)
Plecotrema cubense (Pfr.).
Blauneria heteroclita (Mont.).
Microtralia minuscula (Dall).
Truncatella clathrus Lowe.
Truncatella caribæensis pulchella Pfr.
Truncatella bilabiata Pfr.
Littoridina monroensis (Ffld.).

Paludestrina? sp.? A single specimen that I can not approximate to any of the described species.

This is the first record, I believe, for *Plecotrema cubense* from the mainland of Florida. Originally described from Cuba, it was listed from the Bermudas by Dr. Pilsbry in 1900, (Trans. Conn. Acad., X, p. 504, pl. lxii, fig. 11), and there figured by him for the first time. Both he and Mr. John B. Henderson inform me that they have collected it on several of the Keys and I am indebted to both of them for the opportunity of comparing my specimen with theirs.

Chester Shoals Refuge Station.

Euglandina rosea (Fer.).
Polygyra auriculata (Pfr.).
Polygyra uvulifera (Shutt.).
Polygyra cereolus (Mühlf.).
Polygyra cereolus carpenteriana (Bld.).
Polygyra cereolus septemvolva Say.
Polygyra cereolus volvoxis (Pfr.).
Praticolella jejuna (Say.).
Melampus coffeus (L.).
Detracia bulloides (Mont.)
Lymnaea humilis Say.
Physa cubensis Pfr.
Planorbis tumidus Pfr.
Planorbis alabamensis Pils.
Chrondropoma dentatum (Say).
Truncatella bilabiata Pfr.
Truncatella clathrus Lowe.
Littoridina monroensis (Ffld.).

Between Chester Shoals and Cape Canaveral.

Polygyra cereolus (Muhlf.).
Polygyra cereolus carpenteriana (Bld.).
Polygyra cereolus volvoxis (Pfr.).
Polygyra uvulifera (Shutt.).
Zonitoides minuscula (Binn.).
Pupoides modicus (Pfr.).
Gastrocopta pentodon (Say).
Gastrocopta pellucida hordeacella (Pils.).
Gastrocopta rupicola (Say).
Melampus coffeus (L.).
Detracia bulloides (Mont.).
Blauneria heteroclita (Mont.).
Chrondropoma dentatum (Say).
Truncatella bilabiata Pfr.
Truncatella clathrus Lowe.
Truncatella caribæensis pulchella Pfr.

Amnicola. sp.? A single immature specimen.

Canaveral P. O.

Euglandina rosea (Fer.).
Polygyra cereolus septemvolva Say.
Polygyra cereolus volvoxis (Pfr.).
Polygyra cereolus carpenteriana (Bld.).
Pupoides modicus (Pfr.).
Helicina orbiculata Say.

Eau Gallie.

Polygyra cereolus septemvolva Say.
Polygyra cereolus volvoxis (Pfr.).
Polygyra uvulifera (Shutt.).
Physa cubensis Pfr.
Helicina orbiculata Say var.

Island of Eau Gallie.

Polygyra uvulifera (Shutt.).
Praticolella jejuna (Say).
Lymnaea humilis Say.
Physa cubensis Pfr.

Palm Beach.

Euglandina rosea (Fer.).
Polygyra auriculata Say.
Polygyra cereolus carpenteriana (Bld.).
Strobilops floridana Pils.
Strobilops hubbardi (Brown).
Pupoides modicus (Pfr.).
Gastrocopta contracta (Say).
Gastrocopta rupicola Say.
Gastrocopta pellucida hordeacella (Pils.).
Gastrocopta pentodon (Say).
Vertigo milium (Gld.).
Vitrea dalliana ('Simp.' Pils.).
Vitrea indentata (Say).
Zonitoides arborea (Say).
Zonitoides minuscula (Binn.).
Zonitoides minuscula alachuana (Dall).
Guppya gundlachi (Pfr.).
Thysanophora granum (Streb.).
Physa cubensis Pfr.
Helicina orbiculata Say.

Long Key

Euglandina rosea (Fer.).
Polygyra cereolus (Mühlf.).
Polygyra cereolus carpenteriana (Bld.).
Strophia incanum (Binn.).
Pupoides modicus (Pfr.).
Gastrocopta pentodon (Say).
Gastrocopta rupicola (Say)?
Gastrocopta pellucida hordeacella (Pils.).
Gastrocopta pellucida hordeacella (Pils.) var. Small form.
Thysanophora incrustata (Gld.).
Thysanophora granum (Streb.).
Thysanophora dioscoricola (Guppy).

Guppya gundlachi (Pfr.).
Varicella gracillima floridana Pils.
Succinea campestris Say?
Melampus coffeus (L.).
Detracia bulloides (Mont.).
Microtralia minuscula (Ball).
Lymnæa columella Say.
Physa cubensis Pfr.
Helicina tantilla Pils.
Chrondropoma dentatum (Say).
Truncatella caribæensis "Sby.; Rve.
Truncatella caribæensis pulchella Pfr.
Truncatella clathrus Lowe.
Truncatella bilabiata Pfr.
Littoridina monroensis (Ffld.).

Amnicola. sp? A single specimen of a very small, globose form that may be an n. sp. Alt. 1 mm.

COLLECTING IN DIGBY, NOVA SCOTIA.

BY LILLIAN DYER THOMPSON.

While traveling through Nova Scotia and New Brunswick last summer, we stayed for about six weeks at Digby, N. S. Digby is about 200 miles northeast of Boston, and is situated near the Bay of Fundy, opposite St. John, N. B. The town is located on the southeast shore of the Annapolis Basin,—a sheet of water about twenty miles long and ten miles wide. This basin is connected with the Bay of Fundy by a channel about three-fourths of a mile wide at its greatest width. This channel, known as Digby Gap, is noted for its rapid tides,—the rate of flow through the Gap being about eight miles an hour. The tide fall at Digby is thirty feet. The shores of the Basin are sandy, with the exception of the two rocky promentories on each side of the Gap; the one which is nearest to Digby being Point Prim. The town is on a small peninsula on either side of which are two inlets of the Annapolis Basin, known as the Racquet, on the west, and the Jacquet, on the east of Digby proper. On the ebb tide these are almost dry, exposing long mud flats.

There is one island in the Basin, about opposite the Gap and at the mouth of Bear River, called Bear island. From this a long bar extends, called Bear Island Bar, which is covered to a depth of about six feet at low water, and is covered with eel-grass.

Near the Yacht Club pier were found many *Polinices heros*, and their red-brown "sand-collars." In the Jacquet were many *Litorina littorea* and *Litorina rudis*. On the exposed beach, nearer the town, we found *Mytilus edulis*. On the rocks, in the Racquet, we found *Thais lapillus* and a host of *Acmaea testudinalis* ranging in size from one-eighth of an inch to about an inch in diameter. In the mud, at the base of the rocks, were a multitude of *Buccinum undatum*, *Neptunea decemcostata*, ranging in size from one-eighth of an inch to about an inch in diameter. In the mud, at the base of the rocks, were a multitude of *Buccinum undatum*, *Neptunea decemcostata*, and *Colus stimpsoni*, all alive and half-buried. Some dead specimens of *Aporrhais occidentalis* were also found, five of them being full-grown.

On the suggestion of Capt. Danforth, we constructed a dredge, and endeavored to dredge Bear Island Bar from his motor-boat. Here we found quantities of *Lacuna vincta*, *Alectrion obsoleta*, *Cylichna alba*, and two *Polinices triseriata*.

There were some soldiers encamped at Digby, and they used to gather *Litorina littorea* and steam and eat them, without any flavoring. They sometimes ate *Thais lapillus* also. One day, after a rain, we found two *Helix hortensis* crawling along the road.

A NEW TYPE OF THE NAYAD-GENUS FUSCONAIA. GROUP OF F. BARNESIANA LEA.

BY A. E. ORTMANN.

During the study of the nayad-fauna of the upper Tennessee, the present writer found that there exists, in this region, a peculiar type of shells, belonging to the genus *Fusconaia*, the various forms of which have been described previously under a great number of specific names, which, however, seem to belong all to one species. In addition, among material received from L. S. Frierson from the Ozark Mountains, a form was discovered which presented the same structure.

The oldest name for the upper Tennessee form is *Unio barnesianus* Lea. A more detailed account of its various phases is to be given elsewhere, and it suffices here to mention only those

forms which belong here. According to obesity, I distinguish three local, or ecological races:

1. Fusconaia barnesiana (Lea) 1838.

U. barnesianus Lea, '38. *U. meredithi* Lea, '58. *U. pudicus* Lea, '60. *U. Lyoni* Lea, '65. *U. tellicoensis* Lea, '72. *U. lenticularis* Lea, '72.

As the normal (most abundant) forms we may regard *U. meredithi*, *pudicus* and *lenticularis*, which differ from each other only in the development of the rays (topotypes examined). *U. barnesianus* is a slightly more elongated individual, with poorly developed rays. *U. tellicoensis* (topotypes examined) is a *lenticularis* slightly more swollen; and *U. lyoni* forms the transition toward var. *tumescens*, having a little more elevated beaks, greater obesity, and rather distinct rays.

2. Fusconaia barnesiana bigbyensis (Lea) 1841.

U. bigbyensis Lea, '41. *U. estabrookianus* Lea, '45. *U. fassinans* Lea, '68. *Pleurobema fassinans rhomboidea* Simpson, '00.

The most frequent form is *fassinans rhomboidea* (topotypes examined), with rays poorly developed. *U. bigbyensis* has more distinct rays; *U. estabrookianus* (topotypes examined) is an old, overgrown form, without rays; *U. fassinans* is founded upon an individual (type examined, also topotypes), which is exceptionally elongated, without rays.

3. Fusconaia barnesiana tumescens (Lea) 1845.

U. tumescens Lea, '45. *U. crudus* Lea, '71. *U. radiosus* Lea, '71.

U. tumescens is the most typical form, greatly swollen, with more or less developed rays; *U. radiosus* (type and topotypes examined) is less swollen, but for the rest like *tumescens*; *U. crudus* (topotypes examined) lacks rays, and has much eroded beaks, but stands close to *radiosus*.

The mutual relations of these forms may be understood by the help of the following key. Only the three largest divisions are to be regarded as varieties, in the other forms the characters are merely individual, although specimens representing only

one (or a few) of these "forms" often prevail at a given locality.

a_1. Flat, compressed, dia. of shell less than 40 per cent of the length (var. *bigbyensis*).

b_1. No rays, or rays obscure, color of epidermis brown, dark.

c_1. Rhomboid in shape.

d_1. Large. *Estabrookianus.*

d_2. Smaller. *Fassinans rhomboidea.*

c_2. More ovate, tapering behind. *Fassinans.*

b_2. Rays distinct, well developed over most of the disk. Ground color of epidermis lighter. *Bigbyensis.*

a_2. Moderately convex, dia. 40–49 per cent of length. *Barnesiana typica.*

b_1. Beaks not elevated, shape trapezoidal, rhomboid, or subovate.

c_1. Dia. about 41 or 42 per cent; size small.

d_1. Shape somewhat elongate (trapezoidal); rays obscure. *Barnesianus.*

d_2. Shape shorter (rhomboidal).

e_1. Rays obscure. *Lenticularis.*

e_2. Rays present, color of epidermis lighter.

f_1. Rays few. *Meredithi.*

f_2. Rays numerous. *Pudicus.*

c_2. Dia. about 45 per cent; larger. Shape subovate. Rays obscure. *Tellicoensis.*

b_2. Beaks more elevated, shape subtriangular. Dia. 46 per cent, with rather distinct rays. *Lyoni.*

a_3. Much swollen, dia. over 50 per cent. Beaks elevated. (var. *Tumescens*).

b_1. Without rays. Dia. 51 per cent. Beaks much eroded. *Crudus.*

b_2. With rays. Dia. about 56 per cent or more.

c_1. Dia. about 56 per cent. *Radiosus.*

c_2. Dia. about 64 per cent. *Tumescens.*

As to the geographical distribution, it should be briefly stated that the swollen forms (a_3) inhabit the largest rivers; the compressed forms (a_1) are found in the headwaters, and the inter-

mediate forms (a_2) belong to the streams of moderate size. Intergrades are frequent.

Anatomy.[1]

All these shells have the same, and an extremely characteristic and unique structure of the soft parts, so that there is not the slightest question that they belong together. I have examined the soft parts of some 200 specimens in the field, and over three dozens have been preserved in alcohol, and have been examined at leisure in the laboratory. They include representatives of the three main varieties, and of practically all of the individual variations.

Gravid females have been found on the following dates: May 11, '13; May 15, '13; May 16, '13; May 20, '13; May 20, '14, May 22, '14; May 25, '14; July 5, '13; July 9, '13; July 10, '13; July 13, '13; July 14, '13. *Glochidia* have been observed on May 20, '14 (immature), and July 14, '13. Thus this species evidently is a summer breeder (tachytictic).

The soft parts are those of the genus *Fusconaia*: the *supraanal* is separated from the *anal* by a very short mantle-connection, which is absent (or torn?) in rare cases. Inner lamina of inner gills free from abdominal sac. All four gills are marsupial. Placentae well developed and subcylindrical.

Branchial opening with well developed papillae, *anal* with distinct, but small papillae. *Palpi* subfalciform, posterior margins connected at base only.

While thus the *Fusconaia* structure is typically developed, this species is quite unique in its color. This concerns chiefly the color of the gonads, eggs, and placentae.

The soft parts are often uniformly pale, whitish, but may shade to orange, and the orange is most prominent on foot, adductors, and mantle-margin; but the paler tints prevail, and often the orange is replaced by yellowish or brown. The gills

[1] In Nautilus, 28, 1914, p. 31, I have described the anatomy of "*Pleurobema fassinana*." This is a mistake: the shells examined belong to *Pleurobema* all right, but are the form known as *U. argenteus* Lea, which belongs to the *oviforme-group*, and should be called: *Pleurobema oviforme argenteum* (Lea). These will be treated more fully elsewhere.

are pale, but are generally suffused with blackish. The gonads are brown to red, mostly of a peculiar dull lavender color in the female, and the latter color, or purplish brown, is the prevailing color of the eggs and placentae. The charged gills become thus rather dark purple, or purple-brown, shading sometimes to dull red or blackish, in other cases to brownish, brownish pink, brick-red, or even pale brown. These are very peculiar tints, by which this species is easily recognized in the field: four marsupial gills of this blackish-purple color are not known in any other Nayad.

Glochidia have been found only in specimens belonging to the headwaters variety (*barnesiana bigbyensis*). They are subelliptical, slightly higher than long, L. 0.15, H. 0.16 mm.

Although a true *Fusconaia*, this species (or group of forms) stands isolated within the genus, in characters of the shell as well as in the soft parts. It differs from the species of the *subrotunda*-group (incl. *ebena*, *pilaris* etc.) very markedly by its smaller size and by the very shallow beak cavities. The forms of the *undulata*-group (incl. *flava*, and the *cuneolus*- and *cor*-forms) have generally also somewhat deeper beak cavities, and the shell has a more or less distinct posterior ridge, with a flattening or a shallow groove in front of it, characters which are missing in the *barnesiana*-group. As has been pointed out, in the latter group, the color of eggs and placentae is remarkable: in all other forms of *Fusconaia*, this varies from white to bright red.

I introduce here another species, in order to show that the *barnesiana*-type is also represented outside of the Cumberland-Tennessee drainage, namely in the Ozarks.

Fusconaia ozarkensis (Call) 1887.

F. ozarkensis Call, Pr. U. S. Mus. 10, '87, p. 499, pl. 27. Tr. St. Louis Ac. 7, '95, p. 33, pl. 18. *Lampsilis ozarkensis* Meek & Clark, Bur. Fisher. Doc. no. 759, '12, p. 18. *Pleurobema utterbacki* Frierson, in: Utterback, Naiad. Missouri (Amer. Midland Natural 4, 1916, p. 86, pl. 5, pl. 20, f. 63).

I have specimens from James River, Galena Stone Co., Mo., and White River, Cotter and Norfolk, Baxter Co., Ark., do-

nated by L. S. Frierson and collected by A. A. Hinkley on July 30 and Aug. 2 and 5, '14, A number of specimens (8) were preserved in alcohol, coll. July 30 and Aug 2, which all were gravid females, and one of each date had glochidia. This marks probably the end of the breeding season, and the species is tachytictic.

There is some confusion with regard to this species. After the first description by Call, it has not again been recorded, except by Meek and Clark, and I believe, the identification of these authors (supported by B. Walker) is correct. But I think that other authors have seen this form, but have not recognized it, and, for instance, Simpson's *pannosus* and *subellipticus* (regarded as varieties of *Pleurobema argenteum* and *breve* respectively) are also this. Frierson's *utterbacki* is surely this, since my specimens were thus labeled by Frierson.

Walker, Frierson, and Simpson (in part) believe this to be a *Pleurobema*, and not a *Lampsilis* (see also Simpson, '00, p. 557, and '14, p. 131), and this comes nearest to the truth, in fact, it is the most plausible assumption to be made from the study of the shell alone. The shell "resembles a very elongated *Quadrula coccinea*," according to Meek and Clark, and the comparison with *Pleurobema argenteum* and *breve* (which, by the way, are synonyms), made by Simpson, is significant. We must keep in mind that Call's fig. 4 represents the normal shape of the shell, while his fig. 1 is rather abnormal, and possibly does not belong here at all. These two figures by no means represent the female and male, as Call believes.

The investigation of the soft parts has shown that this actually is a *Fusconaia*. Corresponding, both in soft parts and shell, to the *barnesiana*-type of the upper Tennessee region. *F. ozarkensis* differs from *barnesiana* by the more elongated (subtrapezoidal) outline of the shell, more anterior beaks, and the weak development of the rays, which are faint at the best, and often entirely absent. A swollen form of it is not known to me, but specimens from White River are slightly more convex than those from James River (farther up). Also Utterback's quota- of Frierson (p. 87, footnote) make it probable that there are differences in obesity.

Anatomy.

Supraanal opening probably separated from the *anal* by a short mantle-connection, but in all my specimens this is torn by rough handling. Inner lamina of inner gills free from abdominal sac. All four gills marsupial in the female. *Placentae* well developed and *subcylindrical.*

Anal opening with small papillae, branchial opening with well developed papillae. *Palpi* as usual, their posterior margins connected for about one third of their length or less.

As to the color of the soft parts, which is so characteristic in *barnesiana*, not much can be said, since my material has been too long in alcohol. But in most of my specimens the gills are yet distinctly suffused with black. The placentae have been rendered whitish, but here and there traces of a dark stain are preserved (which is disappearing gradually). It is quite possible that the color of the placentae originally was similar to that of *barnesiana.*

The *glochidia* are subelliptical, slightly higher than long; L. O. 15, B. O. 18, thus agreeing with those of *F. barnesiana.*

NOTE ON THE RELATION OF SNAIL FAUNA TO FLOODS.

BY A. RICHARDS.

During the years 1911 to 1916, while the writer was a member of the faculty of the University of Texas, a series of incidental observations on the snail fauna of Waller Creek was made. These observations have now come to an end due to the change of residence of the observer. It seems not unwise, therefore, to publish a short note on the subject in the hope that the facts recorded, although fragmentary, may have a bearing on the work of some other follower of snail life.

Waller Creek is a small stream near the University of Texas at Austin. It is some four miles in length and empties into the Colorado River at a distance of perhaps two miles below the University. That portion of the stream close to the University between Fifteenth and Twenty-seventh Streets, was most closely observed, but data was also collected from the region below.

During the hot months, from about July 1st to October 1st usually, the stream is dry, or water is to be found only in an occasional pool; during the rest of the year the water flows to a depth of a few inches. The bed is scoured out of limestone (Austin Chalk) and has for much of its length a solid flat rock bottom. The banks of the creek have in general a gradual slope. In time of flood and during heavy rains, this stream rises very rapidly and quickly becomes bank-full, so that the water rushes down in a torrent, the roar of which may at times be heard for a distance of some blocks. The fall of the creek is considerable, being about 75 feet in two miles from Twenty-seventh Street to the Colorado, and this fall in connection with the shape of the bed gives to the current in times of flood a tremendous force.

During the first two years of this observation, 1912–1913, the snail population of the creek in its middle stretches was dense. There were in particular two species very thickly represented, *Planorbis lentus* and *Physa halei*. So numerous were they that one could in a few moments within a very few feet gather a pint of either kind. Wherever a little ripple or a tiny waterfall occurred were many snails oriented in relation to the current, their heads pointing into it. Elsewhere in the more quiet water they were also to be found, but in less numbers. These conditions obtained especially in the early spring; as the breeding season, which in that latitude extends over half the year, passes by, the snails of course become much less numerous.

It is to be noted that previous to the time when the snails had become so abundant, there had been no heavy rains of sufficient importance to be recorded since 1908. Excessive rains occurred in May 1908, November and May 1907, June and March 1905, May and April 1904, July and February 1903, July and November 1902. There was a very severe flood in the creek in April 1900. It will be seen that between the time when my observations began and the last excessive rain considerable time had elapsed and the snails had had the opportunity to reinstate themselves in the creek, assuming that they had suffered in those floods as they have done in the later ones.

In the fall of 1913 there were two floods of unusual propor-

tions in the creek. In October it rose very rapidly, but shortly subsided, and in November, at the time when the entire state was visited by the most severe flood since 1869, it was again subjected to a very thorough scouring. Excessive rains fell on several consecutive days, and streams in the entire Colorado watershed were out of their banks.

After the heavy rains of the earlier part of the month there were several days upon which the rainfall, while comparatively light, was sufficient to keep the creek much higher than its normal level. When the water finally subsided to its normal amount the bed was covered completely with a layer of detritus and soft green humus and algae from a half an inch to an inch in thickness. This deposit and the acids formed from it have been the cause of a much more rapid disintegration of the limestone than had been the case in the immediately preceding years. Loose pieces of limestone which were exposed to the action of the water had in many cases fallen apart by the end of January. Further rises occurred on April 27 and on May 20th, 1914, but were not sufficient to remove all of the accumulated layer of detritus.

In January 1914, a search for snails where they had before been numerous failed to reveal a single specimen of *Planorbis* and less than half a dozen *Physa*. Even in the deeper pools they could scarcely be found. Later in the spring in the lowest part of the stream a number of very small *Physa*, as well as some clusters of eggs were found. The force of the current had been so great as to wash the snails down to the river, and it is possible that the condition of the water due to the decomposing humus may have affected those which were able to escape the flood danger. That some of the Physa were left after the flood may be attributed to their pointed shape which decreases the amount of force that the water was able to exert on them as compared with that on the flat Planorbis shells. Except as noted above in April and May 1914, the conditions in the creek remained as normal.

In January 1915, Physa has again made its appearance in the middle parts of the stream, although in small numbers only. Diligent search, however, failed to reveal a single Planorbis.

The snails which were present were found only under fair-sized rocks where they were well protected; they did not occur out in the open stream as had been the case when the creek was more densely populated with snails.

In April 1915, on the 22d and 24th, Waller Creek was swept by three scouring floods which devastated the entire bottoms. The water rose higher during the night than it had at any time since 1886; bridges were washed away and much damage done. The bottom of the creek was again washed clean except under the larger stones and in deep holes in the bed. Snails were not observed in any numbers following this flood during the rest of that year. Early in January 1916, however, Physa had again appeared fairly abundantly where they had formerly been very thick, in the region just above the University; later in the spring they became quite numerous here. In January of this year the first Planorbis were found that had been seen in the creek since the autumn floods of 1913. Between Fifteenth and Sixteenth Streets in a pocket containing good-sized stones over which the water flows rather swiftly a number of specimens were taken, although none were found above or below this locality. It is noted that below this region the creek is frequently covered with oily scum and that it receives the refuse from the adjoining properties. Except after high water which would clean it out, the creek in this region would hardly be expected to support much snail life. It must be supposed either that the Planorbis had made their way up to Sixteenth Street during the short time following the floods before the water became badly contaminated, or else that in this particular place a few specimens from the previous years had withstood the floods and reproduced themselves in sufficient numbers to be noticeable in January. Of these two suppositions the latter seems much the more rational.

After the flood of 1915 the water subsided very quickly so that a new layer of humus and algae was not deposited, but that the bed was again restored to its former condition of a clean smooth rock bottom. Upon the return to this condition the snail population increased very rapidly, and at the time when the last observation was made in the early summer of 1916, seemed in a fair way to return to the condition of 1912.

It seems to the writer that the slow return of the snails during the year 1914 was due not only to the repeated rains of the fall and winter of 1913–14, but also to the condition of the creek bed at this time. Although the heavy rains of 1915 were more severe, they were confined to one month, and the creek bed was left in a very much cleaner condition than during the preceding year.

The conditions of life which obtain now in Waller Creek are those of a new life region. This must of necessity be so in an intermittent stream to a certain extent, but owing to the flood conditions here they are doubly so.

The chief facts of interest in regard to the habits of snails as shown by these observations, are these: 1, The snails of both species are to be found commonly in uncontaminated water which is running at a fairly rapid rate, and the most common orientation is with the heads pointing up stream; 2, The snail population in any stream is subject to wide fluctations depending upon flood conditions; 3, Physa because of its shape is less affected by floods than Planorbis; 4, The return of the snail population to a given stream is determined not only by the frequency and severity of the floods, but also by the condition of the bottom of the stream after the subsidence of the high water; 5, The snails thrive best where there is a constantly renewed supply of clean water which contains little decaying vegetation.

Wabash College, Crawfordsville, Ind.

WILLIAM BULLOCK CLARK.

Dr. William Bullock Clark, professor of geology in the Johns Hopkins University, eminent for his contributions to geology, died suddenly from apoplexy on July 27, at his summer home at North Haven, Maine.

Wm. Bullock Clark was born at Brattleboro, Vermont, December 15, 1860. Since 1894 he was professor of geology in Johns Hopkins Univesity. In 1896 Professor Clark organized the Maryland Geological Society, and has been State Geologist since that time. The admirable volumes on paleontology of

Maryland, issued under his direction, are widely used by conchologists interested in fossil mollusks. This series of reports will be his enduring memorial. Professor Clark's chief paleontological interest was in the *Echinoidea*, upon which he published several monographs.

PUBLICATIONS RECEIVED.

A Monograph of West American Melanellid Mollusks. By Paul Bartsch (Pro. U. S. Nat. Museum, Vol. 53, pp. 295–356, pls. 34–39, Aug. 1917). This completes the discussion of the West American mollusks of the super-family Pyramidelloideae, comprising the family Pyramidellidae, which has been previously treated, and the Melanellidae here considered. The former are readily distinguished by having the "nepionic whorls sinistral and tilted; the axis of the early whorls usually being at right angles to that of the succeeding turns, in the first of which the nuclear whorls are frequently quite strongly imbedded." In the latter the early whorls are dextral and never tilted or immersed. A review of the work done in this group is followed by the descriptions of the species, including forty-nine new species and one new genus *Eulimostraca*. The illustrations are excellent.

New and Little Known Species of South American Mussels of the genus Diplodon. By William B. Marshall (Proc. U. S. Nat. Museum, Vol. 53, pp. 381–388, Pls. 50–55, August, 1917). Two new species *Diplodon felipponei* and *D. fortis* are described and figured, together with six species described by Mr. C. T. Simpson in his Descriptive Catalogue of the Naiades and not previously figured.

Notes on the Shells of the Genus Epitonium and its Allies of the Pacific Coast of America. By William H. Dall, (Proc. U. S. Nat. Museum, Vol. 53, pp. 471–488, August, 1917). An interesting account of the various groups and subgenera is followed by descriptions of forty-two new species.

The name Pictoscala is proposed for a section, type *Scalaria lineata* Say.

Studies on Australian Mollusca. Pt. XIII. By C. Hedley (Proc. Linn. Soc. New South Wales, 1916, vol. 41, pt. 4, pp. 680–719, pls. 46–52, issued April 4, 1917). The author's notes under *Tridacna gigantea* Perry are of such general interest that we quote them in part. "Under the name of *Chama gigas* the father of Natural History seems to have embraced the whole of the modern genus *Tridacna*. For the name *gigas*, as restricted to a single species, the candidates are the shell subsequently named *squamosa* by Lamarck and a huge species whose valves in the Ulrica Museum, together weighed 498 pounds.

"After careful examination, Hanley decided that the fur-belowed clam, such as Reeve has figured for *T. squamosa*, ought rightly to bear the name *gigas*. He based his verdict on the ground that the actual shell owned by Linné as representing *gigas*, is the Lamarckian *squamosa*, and that to this apply most of the literary references. Linnean contemporaries such as Born, Regenfuss and Chemnitz, while making casual references to the giant, all agree in figuring and describing *squamosa* as the Linnean *gigas*.

"Discriminating in 1819 between the species his predecessors had confused, Lamarck unlawfully used the name *gigas* for the largest form, while for the Linnean *gigas* he proposed *squamosa*. Attentive to the remarks of Hanley, Hidalgo in 1903, renamed the biggest species *T. lamarcki*. But in 1811, Perry had already used the name *Chama gigantea* for 'the largest shell at present known.' As the young of the giant has not yet been traced to the adult, it is still possible that *squamosa* is a juvenile deeper-water form of the large intertidal and abraded *gigantea*.

"The heaviest known are a pair weighing 550 lbs., which Cuvier and Lamarck relate were presented by the Venetian Republic to Francis I. These still exist, their edges bound with brass, as holy-water basins in the cathedral of St. Sulpice, in Paris.

"The photographs of Saville Kent show the giant clams in their natural position on the Great Barrier Reef, where they occur free and exposed at low tide, standing on their umbones, and showing their brightly colored mantle and so-called eyes as they gape."

There are many other interesting notes bearing on nomenclature, and the animals of Australian species. Six new species are described and twenty-nine species figured.—C. W. J.

An Annotated List of Shells from Northern Michigan. By Mina L. Winslow (Occasional papers, Mus. Zool., Univ. Mich., No. 42, July 1, 1917) a list of sixty-five species from Schoolcraft, Alger and Chippewa counties, also a list from Isle Royale.

NOTES.

The Oldroyd Collection.—Mr. and Mrs. J. S. Oldroyd have given their collection of shells to the Leland Stanford Jr. University, and are now permanently employed in the Museum, Mrs. Oldroyd being the curator. The collection has been placed in the Department of Geology and Mining. The Stanford alumni purchased the collection and library of the late Henry Hemphill, which, with the Law collection and several others, forms an unusually fine working series. Mr. and Mrs. Oldroyd have spent about eight weeks at Friday Harbor, Puget Sound and British Columbia making large collections for the Stanford University, California Academy of Science and University of California.

North Carolina Land Shells.—The following species of land shells were picked from leaf-mold collected at Spruce Pine, Mitchell Co., North Carolina, by Samuel G. Gordon while on a mineralogical excursion. The specimens are in the collection of the Acad. Nat. Sci., Phila., *Gastrocopta contracta* Say, *G. pentodon* Say, *Circinaria concava* Say, *Polita indentata* Say, *Taxeodonta lamellidens* Pils., *Gastrodonta elliotti* Redf., *G. gularis* Say, *Euconulus sterkii* Dall., *Punctum pygmæum* Drap., *Carychium exile* Lea.—E. G. Vanatta.

A Correction.—In my little paper, "Descriptions of New West American Marine Mollusks and Notes on Previously Described Forms," Proc. U. S. Nat. Mus., Vol. 52, pp. 670–671, plate 46, figure 2, 1917, I published *Cerithiopsis* (*Cerithiop-*

sis) *helena* from Panama, type Cat. No. 204128, U. S. N. M. Mr. Vignal, of Paris, has been kind enough to call my attention to fact that the same combination was used by O. Boettger in 1901 for a fossil in his contribution "Zur Kenntnis der Fauna der mittelmiocänen Schichten von Kostej im Krassò-Szörényer Komitat," in "Verhandlungen und Mitteilungen des siebenbürgischen Vereins für Naturwissenchaften zu Hermannstadt," p. 128, 1901. It is therefore necessary to bestow a new designation on my shell, and it may be known as *Cerithiopsis* (*Cerithiopsis*) *anaitis*.—PAUL BARTSCH.

ALBINISTIC EPIPHRAGMOPHORA FIDELIS.—A few days ago, I had two hours in Gladstone Park. The Park is wooded, and there are large moss-covered rocks. *E. fidelis* was out freely. I found one light one. The one sent you some years ago was uniform in color. This one shows two distinct dark narrow bands around the lower whorl but not showing anywhere else. This is the fourth one I have found in the Park in twenty years or more, though I have been there often.

—J. G. MALONE, *Portland, Ore.*

THE many friends of DR. HERMANN VON IHERING will hear with deep regret that he has been removed by political intrigue from his position of Director of the MUSEU PAULISTA at Sao Paulo, Brazil. This museum was founded by Dr. von Ihering. His eminence as a zoologist and unceasing activity as an investigator of the South American fauna, had won for it an honorable place among scientific institutions. We understand that his successors are men without knowledge of the biological sciences. As the only scientific assistant, Mr. Rudolph von Ihering has resigned, it appears that the scientific activity of the State Museum of Sao Paulo has come to an end—a real calamity to American zoology and paleontology.

Dr. von Ihering is located at present at Hansa de Joinville, State of Santa Catharina. He is in good health, and is engaged in the preparation of his work : "Die biogeographischen Grundgesetze," several chapters of which will deal with mollusks.—H. A. P. & C. W. J.

THE NAUTILUS.

VOL. XXXI. JANUARY, 1918. No. 3

NEW SOUTHERN FORMS OF CARYCHIUM AND THYSANOPHORA.

BY GEO. H. CLAPP.

CARYCHIUM EXIGUUM FLORIDANUM new subspecies. Pl. 8, fig. 4–6.

Differs from the type by its constantly smaller size and the *greatly thickened lip*. The shell is also more tapering, making the last whorl appear swollen.

Of 25 shells measured, from 5 different localities, the largest is 1.73 × 0.81 mm. and the smallest 1.52 × 0.78 mm., the average being 1.64 × 0.78 mm.

Fig. 5, "Snapper Creek Hammock" about 8 miles south of Miami, Fla., measures 1.64 × 0.72 mm. Length of aperture 0.63, width 0.58 mm. Average of 6 shells, 1.61 × 0.70 mm.

Fig. 4, near Coot Bay, Cape Sable, measures 1.73 × 0.78 mm. Length of aperture 0.69, width 0.63 mm. Average of 6 shells 1.67 × 0.78 mm.

Fig. 6, Miami, collected by S. N. Rhoads, measures 1.78 × 0.86 mm. South side of Miami River, about 2 miles above Miami, average of 6 shells 1.61 × 0.77 mm.

Musa Isle, edge of Everglades at entrance to Miami River, average of 6 shells 1.58 × 0.79 mm. The Musa Isle shells are more globose than those from the other localities, the diameter being exactly one-half of the length.

This subspecies is of wide distribution in Florida and I first noticed it in 1895 when I collected a single specimen at Homosassa, Citrus Co. So far as I have seen it is the only form found in the Miami and Cape Sable regions.

Carychium is apparently not present on the Florida Keys as

I have examined "rubbish" from over 20 of them from Key Biscayne to Garden Key, Dry Tortugas; and while I found over 60 species of land shells, there was not even a fragment of *Carychium*, and it is not mentioned in any of Pilsbry's published lists of Key shells.

Types from Snapper Creek Hammock, No. 8569 of my collection.

THYSANOPHORA MACNEILLI n. sp. Pl. 8, fig. 1.

Shell small, globose, with about four well-rounded whorls, suture deep; color chestnut-brown, somewhat shining; surface with faint growth lines and microscopically granulated; apex obtuse, large, more densely granulated than the body of the shell; widely umbilicate with the umbilicus extending to the apex and contained about 5 times in the diameter of the shell. Aperture well rounded slightly oblique, lip thin, partly reflected around the umbilicus.

The type measures alt. 1.50, diam. 1.38, umbilicus 0.29 mm.

Types, fig. 1, from Magazine Point, 8 miles north of Mobile, Ala., No. 8572 of my collection. Also found at Spring Hill and along the Fowl River about 3 miles from the coast in the southern part of Mobile Co.

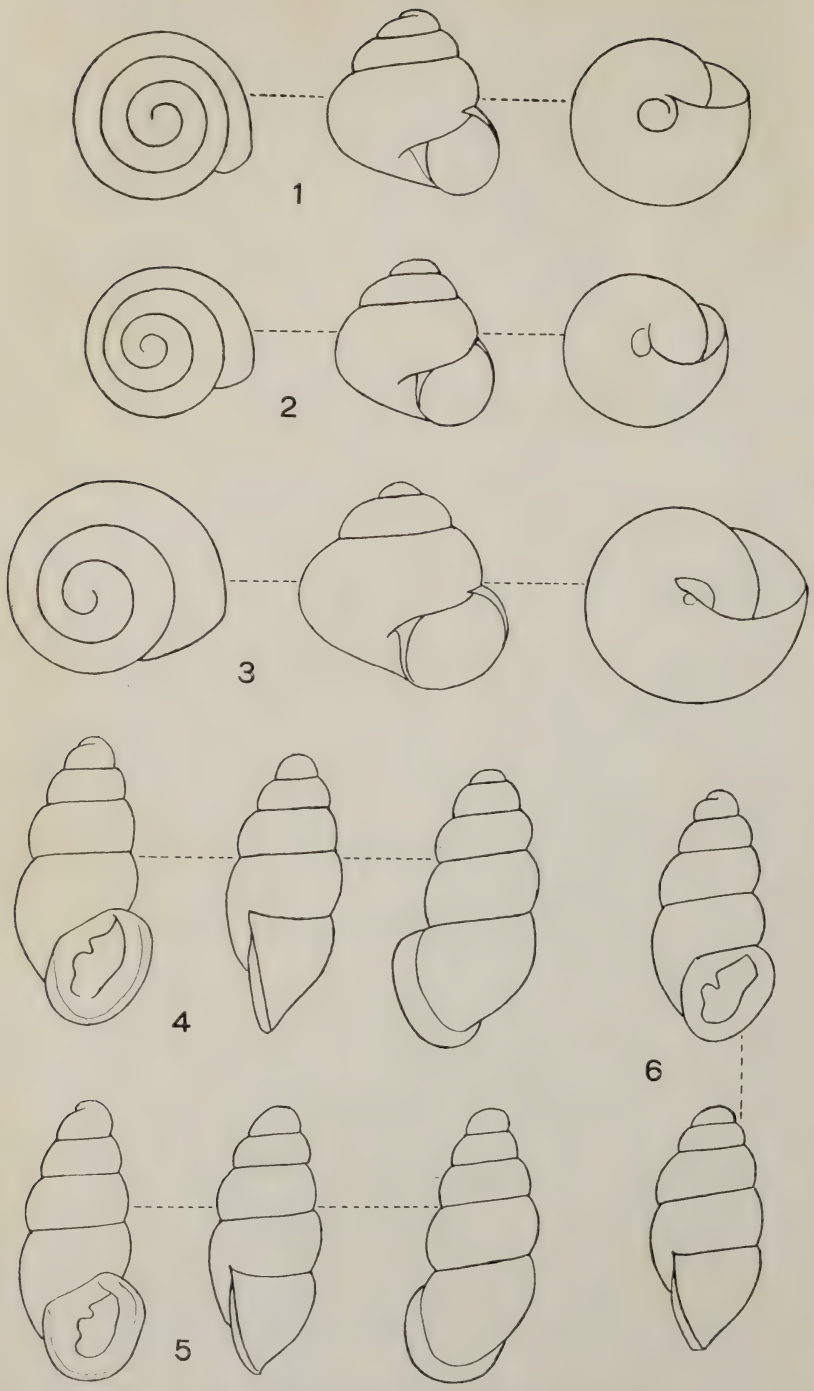
This species is named after the late L. H. McNeill of Mobile, Ala., who first found it in 1914. Mr. McNeill, although handicapped by poor health, was an enthusiastic collector and added much to our knowledge of the molluscan fauna of southern Alabama.

There are two species found in Florida, and probably others of the Gulf states, with which this species may be confused. From *T. dioscoricola* (C. B. Ad.) it differs in the wider umbilicus, less oblique aperture and in having about $\frac{1}{2}$ whorl more in the same diameter.

T. caeca (Guppy) is a larger, more depressed shell, subangular at the periphery, umbilicus nearly covered, and surface with *distinct spiral sculpture.*

EXPLANATION OF PLATE 8.

Fig. 1, T. macneilli Clapp $\times$ 16.6, alt. 1.50, diam. 1.38 mm.



CLAPP: NEW CARYCHIUM AND THYSANOPHORA.

Fig. 2, T. dioscoricola (C. B. Ad.) × 16.6, alt. 1.38, diam. 1.27 mm.
Fig. 3, T. caeca (Guppy) × 16.6, alt. 1.67, diam. 1.73 mm.
Fig. 4, C. e. floridanum Clapp × 21, alt. 1.73, diam. 0.78 mm.
Fig. 5, C. e. floridanum Clapp × 21, alt. 1.64, diam. 0.72 mm.
Fig. 6, C. e. floridanum Clapp × 20, alt. 1.73, diam.0.66 mm.

THE ANATOMY OF TWO AFRICAN NAYADES, UNIO CAFFER AND SPATHA WAHLBERGI.

BY A. E. ORTMANN.

Unio caffer Krauss, Sued Afr. Moll. 1848.

Nodularia caffer Simpson, Synopsis, 1900, p. 825.

Unio caffer Simpson, Descript. Catal. 1914, p. 574.

When Simpson placed this species in *Nodularia*, the anatomy of only two species of this genus was known, and these had the inner gills marsupial. We know now, that Simpson's *Nodularia* is altogether a conglomerate of entirely heterogeneous forms. The present species was placed by Simpson (in 1914) in *Unio*, since he had seen gravid specimens. But he does not give any particulars as to the structure of the soft parts, and thus it is desirable to give an account of them.

I am indebted to B. Walker for the soft parts of a number of specimens of this species, collected at two localities; Lindague Spruit, Natal (trib. to Little Tugela River, coll. in July 1913); and Premier Mine Pumping Station, junction of Elands and Wilge River, near Pretoria, Transvaal (coll. April 1914).

The gravid females collected in July had mostly eggs, but one of them had glochidia; of those collected in April only one female was gravid, and also had glochidia. It is hardly possible to draw from these dates a conclusion as to the breeding season, except that it might begin in July, provided that there is at all a definite season.

Anatomy: *Anal opening* separated from the *supraanal* opening by a moderate mantle connection, slightly shorter than the anal. Supraanal about as long as or slightly longer than the anal. The latter with the inner edge almost smooth. *Branchial*

opening with distinct papillae. No differentiating structures on mantle-edge in front of branchial. *Palpi* subfalciform, of medium size, their posterior margins united for nearly half their length.

Gills of the Unionid-type: gill diaphragm complete, separating anal and branchial openings. Anterior end of inner gills widely remote from the palpi. Inner lamina of inner gill free from abdominal sac, except at anterior end.

Septa and *water-tubes* present, the former continuous and not interrupted, parallel to the gill-filaments. In the male, and in the inner gill of the female, they are weak and distant from each other. *The outer gill of the female is marsupial* practically in its entire length, with heavy and crowded septa.

When charged, the marsupium is moderately swollen, the edge remaining sharp. *Placentae* lanceolate and compressed, moderately developed, when eggs are present, less so, when glochidia are present.

Glochidia subtriangular in shape, longer than high, lower margin bluntly pointed in the middle; hooks have not been observed, but there is a slight swelling of the margin at the point, without any spinules. It might be that both of my specimens contain only immature glochidia, and that the mature glochidia have hooks of the Unio-type: but the glochidia do not look like immature ones. Size of glochidium: L. 0.23 to 0.25; H. 0.20 to 0.21 mm. (in *Unio pictorum*, L. and H. is 0.21 mm.).

The structure is that of the subfamily *Unioninae*, and especially of those genera which have only the outer gills marsupial. Considering the general shape of the shell, zig-zag beak sculpture, anatomy and glochidia (tringular shape of the latter and their size), this species stands very near to the genus *Unio* in the modern sense (Ortman, Ann. Carm. Mus. 8, 1912, p. 273); the only difference is, that the glochidia, although possessing the characteristic triangular shape, have no hooks but this might be due to immature condition.

For the present, it is advisable to retain this species in the genus *Unio* (*U. pictorum* as type), and there is no doubt that it stands at least *very close to it.* If a separate generic (or subgen-

eric) name should be found to be necessary, *Cafferia* Simpson should be considered.

SPATHA (SPATHA) WAHLBERGI (Krauss).

Simpson, Descr. Cat. 1914, p. 1326.

From Mr. W. Israël I have received two specimens from Mkata River (tributary to Wami R.), and two specimens from Ngerengere River (tributary to Kingani or Ruwu R.) both near Mrogoro, German East Africa (collected by Mr. Rudolf). They all resemble each other, but the specimens from the Mkata have a brownish epidermis, those from the Ngerengere a blackish brown one. They agree well with the description and figure of *S. natalensis* Lea (Obs. xi. 1887, pl. 20, f. 58), which is a synonym of *wahlbergi* Krauss.

The specimens from the Mkata are both females, those from the Ngerengere are male and female.

In NAUTILUS 24, 1910 pp. 39–42, I have described the soft parts of *Spatha kamerunensis* Walker, a West African form, which belongs to the subgenus *Aspatharia* Bourguignat. The present species is a real *Spatha*, and the examination has shown, that it closely resembles *kamerunensis* in its anatomy, with the exception of one detail.

Anal opening ovate, about as long as the branchial, closed above by the union of the inner edges of the mantle, *without a supraanal opening.* Edge of anal thickened and wrinkled, but without papillae, probably capable of a moderate tubular extension (siphon). Anal separated from the branchial opening by a *solid connection of the mantle edges. Branchial defined below (or anteriorly) by connection of the inner mantle edges*, which, however, is short, shorter than the branchial (about one fourth to one third as long). In one of my specimens, this connection is torn apart, but still distinctly recognizable. Edge of branchial somewhat elevated and with small or indistinct papillae, probably also forming a short siphon. Farther in front, the mantle edges are unconnected and smooth.

Palpi and *gills* exactly of the structure described in *Spatha kamerunensis.* Also here the inner lamina of the inner gills is free from the abdominal sac, and the septa of the gills are of

the same general character. In the female, the septa of the of the inner gill possess, close to the outer lamina, a marked swelling, by which the female may be recognized at once (the swellings are distinctly seen with a hand-lens).

Thus *Spatha wahlbergi* differs from *S. kamerunensis* only by the *presence of a mantle connection below (or in front of) the branchial opening*, by which this opening becomes perfectly closed and subtubular. Whether this is a general character, which distinguishes the subgenera *Spatha* and *Aspatharia*, remains to be seen. There is no doubt, however, that this character indicates a higher specialisation of *S. wahlbergi*, as compared with *S. kamerunensis*. Attention should be called to the fact, that in the South American shells of the Hyriine-type, this mantle connection anterior to the branchial is rather variable, and may or may not form a generic character (NAUTILUS, 24, 1911, pp. 117, 118).

A NEW CUBAN ZACHRYSIA.

BY H. A. PILSBRY.

ZACHRYSIA RAMSDENI n. sp. Pl. 7, figs. 5, 6.

The shell is depressed-globose, imperforate, of an olive-ocher color, glossy. First $1\frac{2}{3}$ whorls smooth, following neanic whorls irregularly wrinkled, the last whorl sharply striate above, the base nearly smooth. The periphery is rounded, last whorl descending in front. The aperture is very oblique; outer lip slightly thickened, unexpanded. The base-columellar margin is slightly concave, narrowly reflected and depressed, having a very small nodule nearer to the columella than to the base.

Alt. 13.5, diam. 17.5 mm.; 4 whorls (type).

Alt. 12.5, diam. 15.8 mm.

Manati, Los Canos estate, near Guantanamo, Cuba. Type No. 117482 A. N. S. P., collected by Charles T. Ramsden.

This species resembles *Z. emarginata* Pfr., but differs by the much thinner peristome and especially the narrower base-columellar lip. This forms a wide, flat plate in *emarginata*, but is much narrower in *ramsdeni* than in any other species of the

group. The tooth on the basal lip is much smaller than in *emarginata.*

Specimens have been in the collection of the Academy for many years labeled "*H. emarginata*?" One lot from Bland has the query "can these be young *emarginata*?" on the label —Another lot was in the Van Nostrand collection, two specimens having been given to the Academy. The collector of these shells is unknown.

Other views of the specimens now figured were given in NAUTILUS, vol. 28, April, 1915, pl. 6, figs. 2, 2*a*, when I first recognized the form as new.

Z. emarginata (pl. 7, fig. 7) was first found by Gundlach at Caimanera, on Guantanamo Bay, only dead ones in this arid place. Afterwards he collected it at Mayari. Mr. Ramsden has sent it from the following localities: Boca de Jaibo, 1 mile below confluence of Jaibo and Guantanamo rivers. Arroyo Hondo, Los Caños, Guantanamo, Vinculo de Guantanamo. Colonia "Blanco," 2 miles southeast of Guantanamo. Also a dead shell from Caimanera, Gundlach's original locality. Fossil specimens were sent by Mr. Aman some years ago from a deposit of clay at Guamo, on the Rio Cauto. Specimens from all of these localities have been examined by the winter. There is not much variation except in the height of the spire.

REICHENBACH'S ZOOLOGIE.

Allgemeine Taschenbibliothek der Wissenschaften. Fünfter Theil. Zoologie oder Naturgeschichte des Thierreichs. Erstes Bändchen. Dresden. P. G. Hilschersche Buchhandlung. 1828.

Zoologie oder Naturgeschichte des Thierreichs, nach eigenen Ansichten bearbeitet von H. G. Ludwig Reichenbach, etc., etc. Erstes Bändchen.

The series and special title pages quoted above are those of a little-known book which I have been able to examine by the kindness of Dr. Charles W. Richmond, the well-known ornithologist and expert on bird nomenclature. Except for the new

names introduced in the work, there is little original for its time, or of interest now ; but a notice of the generic names is in order. A few of the new names are merely variations of the spelling of well-known older names, some perhaps changed inadvertently, others being feminine forms of originally masculine names. Reichenbach appeared to favor Venus, as Montfort favored Mars. I note the following ; the names which they presumably equal are supplied in brackets.

Lithotornus Cuv.; p. 88 [*Lithodomus*].
Padollia Montf.; p. 91 [*Padollus*].
Ricinella Lam.; pp. 92 138 [*Ricinula*].
Melampa Drap.; p. 93 [*Melampus*].
Scarabaea Montf.; p. 93 [*Scarabus*]. Also p. 152, where *S. imbrium* is mentioned as typical.

Another series of names, for which no authorities are given, and which are therefore to be credited to Reichenbach, are defined by references to vernacular names in Montfort, or are substitutes for earlier generic names. All of the following except the last are evidently considered to be subgenera or other subdivisions of *Murex* L.

Lathiria (les lathires Montf.); p. 91 [*Latirus* Montf.].
Brontesia (Brontes Montf.); p. 91 [*Brontes* Montf.].
Typhlia (les Typhlis Montf.); p. 91 [*Typhis* Montf.].
Cichorax (les Chicoracés Montf.); p. 91 [*Chicoreus* Montf.].
Aquilla (les Aquilles Montf.); p. 91 [*Aquillus* Montf.].
Trophones (les Trophones Montf.); p. 91 [*Trophon* Montf.].
Appollia (les Apolles Montf.); p. 91. [*Apollon* Montf.].
Chondrina R. (*Chondrus* Cuv. non Lamx.); p. 93.

The Zweites Bändchen was published in 1836. The author notes the delay on p. 272. The pagination is continuous with the first volume. The system is developed, with some description of the genera and one or more species mentioned.

On p. 152 the name *Chondrina* is defined (as a subgenus or subordinate group of *Helix*) with the words: "mit eiförmiger Schale—*H. avenacea*, Hafer Sch." *Avenacea* was one of the species of Cuvier's *Chondrus* (for which *Chondrina* was proposed as a substitute). As it is the only species cited under

Chondrina, it becomes type of that group. No type had been selected previously for *Chondrus*. *Chondrina* will therefore replace *Modicella* Ads., 1854, as used by Boettger and Westerlund. So far as I know, the other names proposed had all been provided with valid names previously.

The work covers the invertebrates only. There are some new generic names in other Classes, as well as those in *Mollusca* noticed above.

H. A. Pilsbry.

FURTHER NOTES ON THE MOLLUSCA OF ONEIDA LAKE, NEW YORK; THE MOLLUSKS OF LOWER SOUTH BAY.

BY FRANK C. BAKER.

In a previous paper[1] the writer listed the fresh-water mollusks of the west end of Oneida Lake, 62 species and races being represented. In the present paper the fresh-water mollusks of a large bay in Oneida Lake are listed, the additional material bringing the total molluscan fauna of the lake to 91 species and races, of which 5 are new to science. It is highly probable that half the species of fresh-water mollusks inhabiting the State will be found in Oneida Lake when the east end, the deep water, and the small tributary streams are examined. The additional Sphæriidæ collected in 1916 is noteworthy, bringing the total number to 32, of which 23 are Pisidia. The deeper water also added several species of note not found in 1915.

Mollusks were abundant everywhere, being absent from less than one percent of the area examined. Associated with the mollusks were oligochæte worms, planarians, leeches, amphipods and other crustaceans, fresh-water insects and insect larvæ, and the little water mites, forming together a veritable microcosm, in which the majority of fresh-water groups of animals were represented. In point of numbers the mollusks usually predominated. The studies in Lower South Bay were carried on quantitatively for the purpose of ascertaining the available amount of fish food present in this body of water and its im-

[1] The Nautilus, xxx, pages 5–9, 1916.

mediate vicinity. During the field work, 18,440 specimens were collected, of which, 9335 were mollusks. Ecological notes were made on all of the species in connection with the environment and with the associated animals. The discussion of these topics, many of which are of an economic nature, will be published as a technical bulletin by the New York State College of Forestry, and the interested reader is referred to this publication for details concerning these and kindred subjects.

When the field work was made for the material upon which Technical Bulletin Number IV (page 89) is founded the deeper water of the west end of the lake was examined with a crowfoot dredge, and, naturally, only a few mussels were obtained. For the field work of 1916 a large dredge with a 16-inch frame was used with very satisfactory results, a large number of clams as well as gastropods being collected. When these results were tabulated an interesting variation in bathymetrical distribution was observed. This is indicated in the table below:

Table showing decrease of mollusks with depth.

Shore to six inches	6 species
1 to 3 feet	46 species
3 to 6 feet	40 species
6 to 9 feet	39 species
9 to 12 feet	29 species
12 to 15 feet	26 species
15 to 18 feet	11 species

Lower South Bay is the largest embayment of Oneida Lake and is situated at the southwest end. It is about one by two miles in extent and covers an area of approximately 881 acres. It is well protected on the north by Long Point which extends eastward into the lake for nearly a mile, forming an effectual barrier to the heavy north and northwest storms. Between Long Point and Short Point (see the map in Technical Bulletin, IV) lies Short Point Bay where the water is usually quiet and the habitats are sheltered from strong waves. The greater part of the shore is of sand or clay, a very small proportion being of gravel and boulders. The deeper water has a mud bottom. The 881 acres included in the area of Lower South Bay is divided as follows:

Boulder and gravel bottom	20 acres
Sand bottom	85 acres
Clay bottom	92 acres
Mud bottom	684 acres
Total acreage	881

Plant life is very abundant in the bay and it is due to the great quantity of this life that the animal life is so abundant. The submerged plants are the most abundant in species, *Potamogeton*, *Najas*, *Elodea*, *Vallisneria* and *Myriophyllum* being the principal genera represented. *Scirpus*, *Pontederia*, *Nymphæa* and *Castalia* are the most abundant of the emergent types of vegetation. The most surprising result of the plant analysis has been the presence of great quantities of filamentous and other algæ, the former in places fairly choking the water. Upwards of 36 species were found in the material examined by Dr. E. N. Transeau, including *Cladophora*, *Oedogonium*, *Ulothrix* and *Spirogyra* among the filamentous species. It was in this mass of algæ, which often formed a thick blanket, that the greater number of mollusks and other animals were found.

In the list of species to follow, reference is made to the depth of water and to the character of bottom upon which the species was found. As all but a very few were collected in Lower South Bay, the locations are given only where the species was found in a habitat outside of this area. My thanks are due Dr. H. A. Pilsbry, Dr. Bryant Walker, and Dr. V. Sterki for the determination of critical material. To Dr. C. C. Adams and Dr. Hugh P. Baker, of the New York State College of Forestry I am indebted for the opportunity of making the studies from which these notes are abstracted.

Unionidae.

Elliptio complanatus ("Solander" Dillwyn). In Technical Bulletin, IV, page 252, and in the Nautilus, XXX, page 8. reference is made to the presence of *Margaritana margaritifera* (L) in the lake. This should be eliminated from the lists as it was founded upon pathologic individuals of *Elliptio complanatus*. This *Elliptio* is the commonest mussel in the lake occurring on

all kinds of bottom and in all depths of water examined. The deeper water individuals run considerably smaller than those from shallow water.

Anodonta cataracta Say. On all kinds of bottom in 3–8 feet of water.

Anodonta implicata Say. Found only on exposed shores in water two and a half to four feet deep, in sand between boulders.

Anodonta grandis footiana Lea. Occurs on all kind of bottom except boulder in water one and a half to 15 feet deep.

Lampsilis luteola (Lam.). On all varieties of bottom except gravel in water 3–18 feet deep.

Lampsilis radiata (Gmelin). Found only in water one and a half to three feet deep on boulder, gravel, and sand bottom. Typical *radiata* is very rare in Oneida Lake.

Lampsilis radiata oneidensis Baker. Common in water from 8–18 feet deep on gravel and mud bottom, usually the latter. This species replaces *Lampsilis borealis* (Gray)[1] which does not occur in Oneida Lake.

Sphaeriidae.

Sphærium vermontanum Prime. The most abundant of these small clams, occurring in water from one and a half to 14 feet deep and on all varieties of bottom except boulder.

Sphærium solidulum (Prime). Occurs sparingly in water 8–18 feet deep on a mud bottom. Dr. Sterki characterizes it as a small eastern form.

Sphærium sulcatum (Lam.). Found only on a mud bottom in 8–13 feet of water. It is the rarest of these small clams and is a small, slight form, quite unlike the large heavy individuals found in other parts of New York State. It is an interesting case of bathymetrical distribution that *vermontanum* should occur at all depths examined but that *solidulum* and *sulcatum* should be found only at 8 feet and deeper. The last mentioned species was obtained only between 8 and 13 feet.

Musculium truncatum (Linsley). Clay bottom in four feet of water.

[1] See Technical Bulletin, IV, page 257; Nautilus, XXX, pages 74–77, 1916.

Musculium transversum (Say). Occurred on a sand and clay bottom in water one and a half to four feet deep. The individuals are smaller than is normal for the species.

Pisidium abditum Haldeman. Small specimens of this species were found on sand, clay, and mud bottoms, in one and a half to 8 feet of water.

Pisidium adamsi affine Sterki. Gravel bottom in 3 feet of water.

Pisidium complanatum Sterki. Gravel, sand and mud bottoms in water two to 8½ feet deep.

Pisidium compressum Sterki. Common in water one and a half to 14 feet deep on gravel, sand, clay and mud bottoms.

Pisidium compressum lævigatum Sterki. Mud bottom in 13 feet of water.

Pisidium ferrugineum Prime. Occurs in water 3—8 feet deep on sand, clay, or mud bottom. It resembles eastern specimens from New England.

Pisidium neglectum Sterki. A few quite small specimens were collected on a mud bottom in 8½ feet of water.

Pisidium overi Sterki. A single valve of this western species was found in a dredging from a mud bottom in 8 feet of water. This species was first described from South Dakota and was later found in Minnesota. Its occurrence in New York State gives it a wide range eastward.

Pisidium pauperculum Sterki. On sand and mud bottoms in one and a half to 8 feet of water.

Pisidium punctatum simplex Sterki. On sand and sandy clay bottoms in water 1½ to 3½ feet deep.

Pisidium sargenti Sterki. Small individuals were collected on a sand bottom in one and a half feet of water.

Pisidium scutellatum Sterki. One of the most abundant of these minute clams, occurring on gravel, sand, clay, and mud bottoms in water one and a half to 13 feet deep.

Pisidium scutellatum cristatum Sterki. More common than the typical form and occurring usually with it.

Pisidium splendidulum Sterki. Occurs on a clay bottom in 5 feet of water.

Pisidium variabile Prime. Found in water 2–13 feet deep on

gravel, sand, clay, and mud bottoms. Most abundant in mud in 4–11 feet of water. The specimens are smaller than normal.

Pisidium vesiculare Sterki. Mud bottom in water 8–11 feet deep.

A number of *Pisidia* and *Musculia* are still in the hands of Dr. Sterki awaiting identification. They are either peculiar forms of well known species or are undescribed, and several species are represented. Of the material collected in 1915 Dr. Sterki says; "You should have 30 species or more of Sphæriidæ in your vicinity; and there ought to be more than 20 species (plus varieties) of *Pisidium.*" With the 1916 material we nearly reach Sterki's estimate of probabilities—26 species of the family named and six unnamed. Of *Pisidium* there are 18 named species and five unnamed. Several of the species listed are recorded from New York State for the first time. The Sphæriidæ of Lower South Bay consist of small individuals with slight shells and more or less weak hinges due to some physical property of the water, perhaps a lack of lime. The maximum development of this family, both in species and individuals, appears to be in comparatively deep water.

Viviparidae.

Vivipara contectoides W. G. Binney. Collected from a mud bottom in 9 feet of water. Only one specimen, half grown, was found and this was probably brought to its location by currents. This species is abundant in the west end of the lake, near Brewerton, where it lives on a sand bottom in shallow water.

Campeloma decisum (Say.) Collected from a sand and clay bottom in water one and a half to 5 feet deep. More abundant on a clay bottom. The majority of the individuals of *decisum* collected in July 1916 were young or immature, adults being very rare. It seems evident that the young of this species are born in the spring and attain their first year's growth by September or early October. Information concerning the details of the breeding habits of this group of mollusks are desirable.

AMNICOLIDAE.

Gillia altilis (Lea). Occurs on boulder, gravel, sand, and mud bottoms in water 1–14 feet deep. Half-grown and adult individuals were abundant in some habitats.

Somatogyrus subglobosus (Say). A few specimens were collected associated with *Gillia*. All were immature.

Bythinia tentaculata (Linn.). This common species occurs abundantly in Lower South Bay on gravel, sand, clay, and mud bottoms in water 1–14 feet deep. Most abundant on clay and mud bottoms in water 4–14 feet deep. A large percentage of the individuals collected were young or immature. This species is especially abundant in filamentous algæ (mostly *Cladophora fracta*) and a single specimen was collected from a leaf of the arrowhead, *Sagittaria arifolia*. A pint of algæ, representing 100 square inches of area on an old log in 5 feet of water, yielded 97 adult and 1270 young individuals of this species.

Amnicola limosa porata (Say). This is the largest *Amnicola* in the lake, and was found only in three habitats: boulder bottom in one foot of water, sand bottom in four and a half feet, and mud bottom in 18 feet of water. It was most abundant on a rocky shoal in water a foot deep, a single boulder having 54 specimens. Typical *limosa* is apparently not found in this part of the lake.

Amnicola bakeriana nimia Pils.[1] This is the most abundant *Amnicola* in the lake, easily known by its wide swollen shell. It occurs on all kinds of bottom in water from 1–18 feet deep; about 10 per cent of the material collected was immature. Most abundant, as are all of the species of the genus, in filamentous algæ. A single specimen was found on the leaf of *Sagittaria arifolia*.

Amnicola bakeriana Pilsbry. One of the most abundant species in the lake easily recognized by its long spire and deep-sutured whorls. It occurs on all varieties of bottom, though least numerous on boulder and most numerous on clay and mud bottoms where there is a heavy growth of algæ. In depth it is most abundant in water from 3–6 feet deep, and occurs from

[1] NAUTILUS, xxxi, pp. 44–46, 1917.

1–18 feet deep. It was dredged in great abundance on a mud bottom covered with *Cladophora fracta*, in 8½ feet of water. Many immature individuals occur with the adults.

Amnicola oneida Pilsbry. This is the narrowest species in the lake, greatly resembling *Amnicola lustrica* but being more slender. It was first seen in 1915 in a lot of shells from Frenchman Island[1] but only one specimen was secured. It occurs on all varieties of bottom and in all depths of water from one and a half to 15 feet. It is not common on boulder or gravel bottoms, but on sand, clay, and mud bottoms, where there is a covering of filamentous algæ (*Cladophora*, *Oedogonium* or *Spirogyra*) in 2½ to 4 feet of water, it is the commonest mollusk in the region. In one or two dredgings it was found in abundance in 8–9 feet of water but it is not usually plentiful in deeper water. Many young and immature individuals were collected with the adults.

Amnicola clarkei Pils. This small, subacute species was found associated with *bakeriana* in four places, though it is not as abundant as that species. Occurs on sand, clay, and mud bottoms, in water 3–8½ feet deep, usually in filamentous algæ.

Amnicola emarginata (Küster). This characteristic species occurred sparingly in water from 10–18 feet deep on mud and gravel bottoms, usually with the filamentous algæ *Cladophora* and *Spirogyra*.

Pleuroceridae.

Goniobasis livescens (Menke). Found only on boulder and gravel bottoms, on exposed shores or points, in water one and a half to four feet deep. Most abundant in water 1–3 feet deep on a boulder shore. Many young and immature individuals occur. The species as it is found in Lower South Bay varies in the obesity of the body whorl, narrow forms occurring, some with faint bands resembling the shell from Illinois called *depygis*. The columella is deeply tinged with purple. Several young individuals were collected having strongly keeled whorls and measuring 16 mm in width and 7 mm in width.

[1] See Technical Bulletin, IV, page 269, fig. 45, No. 21.

VALVATIDAE.

Valvata tricarinata (Say). Found on all varieties of bottom, except sandy clay, and in all depths of water down to 18 feet. It occurs in numbers on a sand bottom at four feet, on clay bottom at 3½ feet, on a mud bottom at 8 and 18 feet, and on a gravel bottom at 15 feet. It is rare on gravel and boulder bottoms in shallow water. In this area it is usually associated with filamentous algæ, *Cladophora* or *Oedogonium*. Many young and immature specimens occurred as well as some variations in the position of the carinæ.

Valvata bicarinata normalis Walker. Occurred sparingly on gravel, sand, clay, and mud bottoms in water 2–6 deep.

Valvata sincera (Say). This is a deep water form and ocurred on gravel and mud bottoms in water 11½–18 feet deep, usually associated with the alga *Cladophora fracta*. It was most abundant in water 15–18 feet deep.

PHYSIDAE.

Physa warreniana Lea. This tadpole snail occured on all varieties of bottom in water from one half to 11½ feet deep. It is abundant, however, only in water one half to one and a half feet deep and the the numbers decrease with depth. A gravel or boulder bottom is the normal habitat of this species when adult, but when young or immature, as was the case with the greater number of individuals collected (1–3 mm) it lives in filamentous algæ (*Oedogonium*, *Cladophora*, *Spirogyra*). Of 47 lots collected in 1916 but six contained adult animals. This seems to be another species that attains maturity in the fall, adults being abundant the previous year, in September, in shallow water where but few immature shells were seen. This form of *Physa* seems to differ sufficiently from *ancillaria* to be considered a species and there seems to be no reason why it should not be called *Physa warreniana*. It varies greatly in the sculpturing of the shell, many individuals occurring that have a smooth, polished shell.

Physa integra Haldeman. Occurs on boulder, sand, clay and mud bottoms in water one and a half to ten feet deep. Most abundant on a sand bottom in water one and a half feet deep,

and on a clay bottom in water two feet deep. The majority of the individuals were young or immature (3–5 mm.) and were frequently associated with algæ (*Oedogonium*, *Chara*, *Nitella*) or with the higher vegetation. In one habitat they were found on *Potamogeton interruptus* and *Myriophyllum verticillatum*.

Physa heterostropha Say? Several young shells (7 mm. long) thought to be this species were found in Tuttle Brook, Chittenango Creek. The surface is smooth and shining and the general slope agrees with shells from Philadelphia which are undoubted *heterostropha*. No adult shells were observed.

ANCYLIDAE.

Ancylus parallelus Haldeman. This characteristic fresh-water limpet was collected from all bottoms except boulder in water one and a half to 11 feet deep, the greater number occurring on a sandy clay bottom in one and a half feet of water. In this area it is associated with filamentous algæ (*Oedogonium*, *Cladophora*) but it is usually more abundant on such plants as *Nymphæa*, *Castalia*, *Typha* and *Sparganium*.

Ancylus fuscus Adams. Young individuals of this species were found in one habitat on a sandy clay bottom in one and a half feet of water.

Ancylus species. A single specimen of *Ancylus* was found on a boulder bottom in two and a half feet of water. It was submitted to Dr. Bryant Walker who says of it, "I cannot be sure of the species and therefore prefer to leave it with a question until you get more, which would be very desirable. It does not seem to be any of the more common species."

PLANORBIDAE.

Planorbis trivolvis Say. Specimens of typical *trivolvis* were found in but one habitat, a quiet lagoon on a mud bottom in one and a half feet of water.

Planorbis trivolvis variety. This form of *trivolvis*, listed in Technical Bulletin No. IV, page 277, was again obtained in 1916, on sand, boulder, gravel and clay bottoms in water one and a half feet deep. Ecologically this form of *trivolvis* differs from the typical form and it would be convenient for it to have

a name. It is suggested that the name *fallax* of Haldeman is applicable and seems to represent a shell of the kind here indicated.

Planorbis binneyi Tryon. Common on a boulder shore in one half to one and a half feet of water. Also collected on sand and clay bottoms in one and a half to five feet of water. The majority of the specimens were young or immature. Three young individuals were found on a leaf of *Sagittaria arifolia.*

Planorbis antrosus Conrad. Occurs on all varieties of bottom, in water one and a half to 18 feet deep. It is more abundant at a depth of one and a half to three feet on a sand or clay bottom, and is usually associated with the filamentous algæ *Cladophora* and *Oedogonium.* Also found on floating leaves of *Potamogeton natans.* The majority of individuals were young or immature and the adults were smaller than normal.

Planorbis campanulatus Say. Common on all varieties of bottom in water 1–9 feet deep. It is most abundant on a sand bottom in 1½–5 feet of water. In most habitats it is associated with filamentous algæ (*Oedogonium*, *Cladophora*, *Spirogyra*). About half the individuals collected were young or immature.

Planorbis parvus Say. Occurs on all varieties of bottom in water 1½–12 feet deep, but is most abundant on clay, sand, and mud bottoms in water 1½–4 feet deep. It is usually rarest on boulder bottoms, but on a shoal north of Dunham Island a single boulder 6x4x3 inches had 15 *parvus* on its surface. This species is usually associated with the algæ mentioned under the last species and is also frequently found on the leaves of *Nymphaea*, *Castalia*, *Sagittaria arifolia*, *Myrioyhyllum*, and *Potamogeton interruptus* and *Richardsoni.* *Parvus* is the most abundant *Planorbis* in the region the algæ in many places being filled with this species and one of the Amnicolas.

Planorbis hirsutus Gould. This species occurs on all varieties of bottom except clay, in water 1½–9 feet deep, being most abundant at 3–4 feet on a sand bottom. Rare on boulder and gravel bottoms. Associated with filamentous algæ.

Planorbis deflectus Say. This species is apparently rare in Lower South Bay occurring in but three habitats, on a gravel bottom in 2½ feet of water.

Planorbis exacuous Say. Occurs on all varieties of bottom in 1½–15 feet of water. Most abundant on sand and mud bottoms in 2–5 feet of water. It is rare on gravel bottom but is fairly common on boulder bottom, two to four individuals being found on each stone.

Segmentina armigera (Say). This species was collected in two habitats, one a swampy shore in Short Bay among the alga *Oedogonium* and the other in a protected bay on the north side of Frenchman Island, on leaves of *Sagittaria arifolia.* Both habitats are in shallow water with mud bottoms.

Lymnaeidae.

Lymnæa stagnalis lillianæ Baker. This, the largest of the gastropods in the lake, was found only in one habitat, the rocky shore of the lake, east of Norcross Point, in water a few inches to two feet in depth. All were immature, half or three-quarters grown. A single young shell (dead) 14 mm. in length was found in a small bay on the south shore of Long Point in water 3½ feet deep, but it had evidently been brought there from some other habitat.

Pseudosuccinea columella chalybea (Gould). Collected in two habitats, a protected bay on *Nymphæa* leaves, and a partly enclosed lagoon among filamentous algæ, *Oedogonium.* All specimens were immature.

Acella haldemani ("Deshayes" Binney). Observed in two habitats on submerged vegetation, always in a protected situation, in water from 1—4 feet deep. All of the specimens were young, none exceeding 10 mm. in length, and were invariably found on the narrow leaves of *Potamogeton interruptus.* For the ecology of this species see the Nautilus, XXX, pages 135–138.

Galba catascopium (Say). One of the most abundant of Oneida Lake mollusks, found on all varieties of bottom in water 1½ to 14 feet deep. It is most abundant on sand and mud bottoms, associated with filamentous algæ, when young, and on boulder and gravel bottoms when adult.

Galba obrussa (Say). A single dead shell of this species was found in a dredging on a bar near a small lagoon east of the steamboat landing in 1½ feet of water. It was young, 5 mm.

long, and had evidently been washed into this habitat from some region along shore.

Galba humilis modicella (Say). Found in two habitats, one a lagoon among floating algæ (*Oedogonium*) and the other in Tuttle Brook, a tributary of Chittanango Creek, near the shore, in a few inches of water among the algæ *Oedogonium* and *Cladophora*. In the latter the mollusks were very abundant crawling on the shore at the margin of the water.

SUCCINEIDAE.

Succinea retusa Lea. Small specimens of this species were very abundant along the shore at Becker's landing, crawling over the rocks on the shore near the margin of the lake.

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NEW LAND SHELLS FROM CALIFORNIA AND NEVADA.

H. A. PILSBRY AND JAS. H. FERRISS.

EPIPHRAGMOPHORA CALLISTODERMA n. sp. Pl. 7, fig. 3.

The shell is narrowly umbilicate, thin, cinnamon-brown, fading on the base to tawny olive, having a chesnut-brown band at the shoulder, with a wide border below and a narrow one above of olive buff. Sculpture of inconspicuous growth-wrinkles, and under the microscope, it is seen to be set with rounded pustules in high relief (about 35 in a square mm. on the upper part of the last whorl); they are rather irregularly arranged, along the growth-wrinkles the surface between pustules having very beautiful fine and close sculpture of wrinkles, which are parallel in spiral bands on the shell, elsewhere irregular and interrupted. This gives the shell a many-banded appearance, in certain lights.

Whorls nearly 5½, narrow and closely wound, the last relatively very wide, broadly rounded peripherally, descending a little in front. The aperture is large, oblique, margins but slightly expanding, at the columella dilated partly over the umbilicus. Alt. 16, diam. 23 mm. oblique alt. of aperture 13, width 14 mm.

Margin of Kern River 2 miles north of Bakersfield, Tulare Co., Cal., on an island formed by an irrigation ditch ; on dead vegetation at the water's edge. Collected by Ferriss and Hand, July 1, 1916.

This species differs from all forms of *E. mormonum* and *E. hillebrandi* by its much smaller umbilicus, far wider spire, and the more inflated last whorl. The embryonic whorls of the two species mentioned are densely papillose, while the new form has a pattern of close, irregularly radial wrinkles. It is not closely related to any other species known to us.

OREOHELIX HANDI n. sp.

A member of the *O. hemphilli* group. The shell is thin, depressed, very strongly keeled throughout, irregularly striate, decussated by spiral lines producing a rather indistinct granulation. On the other base there are spiral series of granules. In young shells and mostly adults, there are short cuticular processes on the granules and at the periphery. There are $4\frac{1}{2}$ whorls. The first $1\frac{1}{2}$, forming the embryonic shell, are strongly convex, the first whorl almost smooth, after which a few radial ripples appear. The first part, embryonic whorl, is very convex but begins to be impressed near the periphery. Subsequently the whorls are excavated on both sides of the suture, and the last one is concave above and below the peripheral keel. In fact it descended a little below the keel. The umbilicus is rather large and funicular. Aperture rather small, the margins converging, thin. There is a band of dark livid brown above and one close below the keel, the rest of the upper surface being clouded or suffused with the same color with lighter patches and streaks ; keel usually whitish. Alt. 5.7, diam. 10.2 mm.

Charleston Mountain, Lincoln Co., Nevada. This is about 30 miles north of Las Vegas, Nevada. Collecting was done for about a mile southward from Griffith's Hotel, the elevation about 9000 to 9500 ft.

This species is related to *O. hemphilli* and *O. eurekensis*, but differs from both by its more depressed, much more strongly keeled form. *O. hemphilli* is also much larger and more solid. Its locality is about 200 miles northeast from Charleston

Mountain. Whether these three forms will eventually be ranked as species or *eurekensis* and *handi* as subspecies of *hemphilli* cannot be determined definitely until further collections are made in Nevada and western Utah. At the present time, there is no evidence of intergradation, yet the territory where such evidence would be looked for is wholly unexplored.

Some hundreds of specimens were collected. There is slight variation in sculpture, but very little in form.

Vallonia cyclophorella Ancey.

A race which may be called *V. c. septuagentaria* P.&F. was taken at Bubb's Creek Falls, Tulare Co. It has fully 70 ribs on the base. Alt. 1.25, diam. 3 mm.

A SUMMER'S COLLECTION AT FRIDAY HARBOR, WASHINGTON.

BY T. S. OLDROYD.

Mrs. Oldroyd and myself had the pleasure of spending our vacation at the marine biological station of the University of Washington at Friday Harbor, San Juan Co., Washington. This group of islands, so wonderful in their wild beauty, is situated between the Strait of Fuca and the Strait of Georgia, north of Port Townsend. The San Juan group comprises more than 100 islands of varying sizes, the most important being San Juan, noted as having been the scene of the last struggle between the British and Americans in the boundary-line dispute from 1852 to 1872; the ruins of the old English camp and blockhouse still remain near Roach Harbor. Friday Harbor, the chief town of the islands, is the county seat of San Juan Co. which includes all the islands of the group. The town is situated on a beautiful bay and is the shipping-point for a large area of unsurpassed agricultural land. They have also one or two large salmon canneries. The islands are nearly all high and prominent and covered with a dense growth of trees, mostly fir. Mount Constitution on Orcus Island is the highest point. From its summit, 2094 feet above the sea, is the finest view to be obtained anywhere of the great panoramic picture of Puget Sound. The

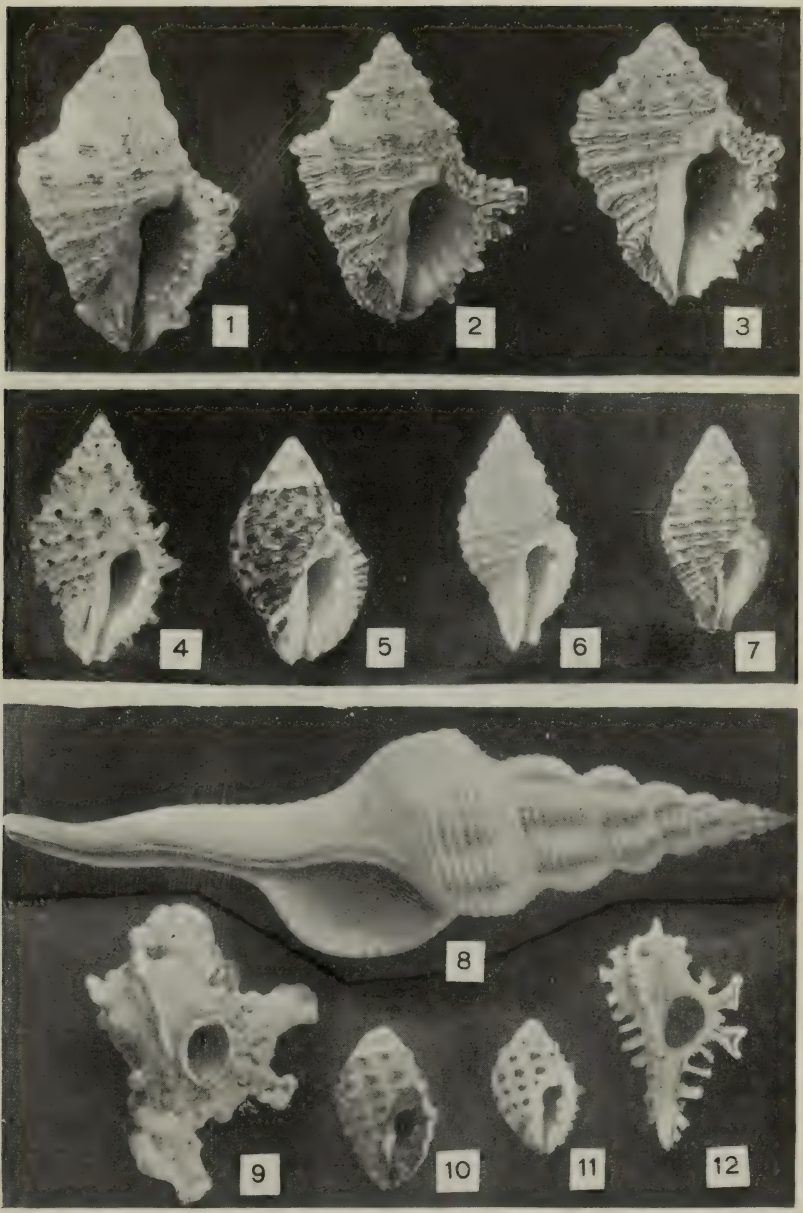
biological station is about one-quarter mile from Friday Harbor, and is under the able management of Dr. T. C. Frye. The camp is situated on a beautiful picturesque heavy-timbered slope and is one of the most healthy places in the world. The islands are a paradise for the botanist and student, as all forms of marine life is here very abundant. Students and visitors are accommodated from all over; tent houses, cots, mattresses, and other things are furnished, all but the bedding; and one needs plenty of covering for the nights are cold. Good table board can be had at nominal rates and visitors are required to pay a small registration fee which entitles them to the use of the boats and the week-end excursions on the dredge boat to places of interest on the islands, and it is well worth the price. The excursions sometimes take two days with a camp out over night, and they have bonfire chats and clambakes in the evenings. Sometimes in the main channels the tide runs swift, but in the bays and protected places and along shore it is as smooth as a mill pond. Although there is a difference of 14 feet sometimes in the tides yet it creeps in and out without a splash or a ripple. This makes it fine for shore collecting on the rocky reefs. It is the best I ever saw. The dredging was done by a small tugboat, a shrimp dredger, and Captain Burnham understood the business thoroughly, having been 25 years on the Sound. He always knew the character of the bottom in nearly every place. We were allowed to go out on the dredge boat every day. At this we were treated especially fine, there being nobody there very much interested in shells, and often for two or three days at a time when they had no special use for the dredge they turned the boat over to us to go dredging where we pleased, an opportunity we were not slow to grasp and make good use of. And just imagine our having to sweep overboard bushels and bushels of those beautiful *Chlamys hericius* Gld. and *hindsii* Cpr. dredged in from 25 to 50 fathoms, not knowing what to do with so many. Mrs. Oldroyd worked like a beaver all the time and did not let many good things get away. The summer school lasted six weeks and a pleasanter time we never spent.

The following is a list of the species we collected during the six weeks:

List of Species Collected at Friday Harbor Summer School.

Nucula castrensis Hds.
Nucula tenuis Mont.
Leda 2 sp.
Leda minuta.
Leda cellulita Dall.
Yoldia amygdala.
Yoldia limatula Say.
Yoldia thraciaeformis Storer.
Yoldia ensifer Dall.
Glycimeris subobsoleta Cpr.
Ostrea lurida Cpr.
Pecten hericius Gld.
Pecten hindsii Cpr.
Pecten hindsii navarchus Dall.
Pecten islandicus Müll.
Hinnites gigantea Gray.
Pododesmus machoschisma Desh.
Mytilus californianus Conr.
Mytilus edulis Linn.
Modiolus rectus Conr.
Musculus laevigatus Gray.
Musculus niger Gray.
Crenella decussata Mont.
Kennerlyia grandis Dall.
Kennerlyia filosa Cpr.
Entodesma saxicola Baird.
Astarte willotti Dall.
Astarte esquimalti Baird.
Venericardia ventricosa Gld.
Miodontiscus prolongatus Cpr.
Thyasira barbarensis Dall.
Axinopsis sericatus Cpr.
Phacoides annulata Rve.
Phacoides tenuisculpta Cpr.
Pseudopythina rugifera Cpr.
Kellia suborbicularis Mont.
Cardium corbis Mart.
Cardium californiense Desh.
Cardium fucanum? Dall.
Serripes gronlandicus Gml.
Transennella tantilla.
Saxidomus giganteus Desh.
Saxidomus giganteus brevis? Dall.
Marcia kennerlyi (Cpr.) Rve.
Marcia subdiaphana Cpr.
Paphia tenerrima Cpr.
Paphia staminea Conr.
Psephidia lordi Baird.
Tellimya tumida.
Tellina salmonea Cpr.
Macoma inquinata Desh.
Macoma balthica Linn.
Macoma yoldiiformis Cpr.
Macoma expansa Cpr.
Macoma secta Conr.
Semele rubropicta Dall.
Psammobia californica Conr.
Solen sicarius Gld.
Mactra nasuta Gld.
Spisula polynyma alaskana Dall.
Schizothaerus nuttallii Conr.
Mya truncata Linn.
Mya arenaria Linn.
Panomya sp.
Saxicava arctica Linn.
Mytilinaria nuttallii Conr.
Hemithyris psittacea L.

Laqueus californicus
Laqueus vancouverensis David.
Terebratulina caputserpentis L.
Terebratulina var. unguicula Cpr.
Terebratalia transversa Cpr.
Terebratalia transversa caurina Gld.
Leptothyra carpenteri Pils.
Leptothyra lurida Dall.
Barleeia sp.
Melanella 2 sp.
Cerithiopsis sp.
Odostomia 2 sp.
Amalthea cranioides Cpr.
Crepidula dorsata Brod.
Crepidula nivea v.
Crepidula adunca Sby.
Tritonalia interfossa Cpr.
Tritonalia lurida Midd.
Bela fidicula Gld.
Boreotrophon stewartii E. A. Sm.
Boreotrophon tenuisculpta Cpr.
Bittium esuriens Cpr.
Fissuridea aspera Esch.
Trichotropis cancellata Hds.
Chrysodomus dirus Rve.
Admete sp.
Haminea virescens Sby.
Chrysodomus tabulatus Baird.
Purpura foliata Mart.
Thais lima Mart.
Thais lamellosa
Thais emarginata Desh.
Margarites helicina Fabr.
Acmaea patina Esch.
Acmaea patina pintadina.
Acmaea pelta Esch.
Acmaea persona digitata Esch.
Acmaea mitra Esch.
Lepeta concentrica Midd.
Velutina prolongata Cpr.
Velutina laevigata mulleri? Desh.
Calyptraea mamillaris fastigiata Gld.
Littorina sitchana Phil.
Littorina scutulata Gld.
Puncturella cucullata Gld.
Puncturella galeata Gld.
Lamellaria sp. may be new.
Columbella aurantica Dall.
Amphissa corrugata Rve.
Calliostoma annulatum Mart.
Calliostoma variegatum Cpr.
Calliostoma costatum Mart.
Margarita pupilla Gld.
Argobuccinum oregonensis Redf.
Buccinum liratum.
Natica pallida.
Natica clausa.
Lacuna 4 sp.
Cancellaria modesta.
Opalia sp.
Olivella sp.
Tornatina sp.
Mopalia wossnesenskii Midd.
Tonicella submarmorea.
Tonicella lineata.
Mopalia lignosa.
Katharina tunicata.
Mopalia muscosa.
20 sp. of Chitons not identified.



1-3. DRUPA FOLIACEA CONR.
4. DRUPA WALKERAE P. & B.
5. " VITIENSIS PILS.
6, 7. PERISTERNIA THAANUMI P. & B.
8. FUSINUS SANDVICHENSIS SOWB.
9, 12. MUREX PELE PILS.
10. DRUPA TUBERCULATA BLV.
11. " MORUS LAM.

NOTES ON SOME HAWAIIAN SPECIES OF DRUPA AND OTHER SHELLS.

BY H. A. PILSBRY AND ELIZABETH L. BRYAN.

The dredging of the channel of Honolulu Harbor by the government has brought to light many shells which were either unknown before or among the greatest rarities to Honolulu collections. The specimens picked up on the "dump" are often quite perfect, though usually somewhat faded. Part of the same species have been dredged alive by Mr. D. B. Kuhns, the senior author having received specimens though Mr. D. Thaanum of Hilo.

DRUPA WALKERAE n. sp. Pl. 9 fig. 4.

Honolulu Harbor, W. A. and E. L. Bryan.

The shell is oblong-fusiform, very solid, the ground color light buff. It is rather weakly plicate longitudinally, the folds and valleys crossed by spiral cords, of which five on the last whorl are larger, bearing *erect liver-brown spines* upon the folds ; two or three small spirals are between each pair of the larger ones ; all of the cords being densely scaly, the scales weaker between the cords. On the penult whorl there are two spiral series of colored spines, and one on each of several earlier whorls. The spine is straightly conic, the apex rather acute (not perfect in any of the specimens). The aperture is rather narrow, white. There is a series of about 6 teeth within the outer lip. The columella is straight, massive, excised at the canal ; below the middle there are several short, transverse and inconspicuous folds.

Length 25, diam. (including spines) 16 mm. (type).

Length 27, diam. (including spines) 16 mm. (old specimen with worn spines).

This handsome species is named for Miss Mary Walker, of Buffalo, N. Y., long an enthuisastic collector of shells. It has some resemblance to *S. fragum* (Blainville), but in that species the aperture is wide, there is a row of spots in place of spines below the suture, and the details of sculpture differ. *S. concatenatum* (Lam.) differs in color, in the absence of strong subsutural spines, the more open aperture, and details of sculpture. Both have shorter spines than the Hawaiian shell, often tubercles rather than spines.

DRUPA FOLIACEA (Conrad). Pl. 9, figs. 1, 2, 3.

P. [*urpura*] *foliacea* Conrad. Journ. A. N. S. Phila., vol. 7, 1837, p. 268, pl. 20, fig. 24.

Atooi [= Kauai] Conrad. Kaena, Kauai and Honolulu Harbor, W. E. and E. L. Bryan. Kewalo beach, east of Honolulu, Pilsbry. "Sheli short fusiform, ventricose, with longitudinal undulations and spiral costæ; whorls with crowded spiral foliated striæ; labrum costate within, margin foliated; columella with an obtuse or obsolete fold. Inhabits the Island of Atooi" (*Conrad.*)

We do not know that this species has been recognized hitherto, though it was quite recognizably described and figured. Tryon in Manual of Conchology, vol. 2, considered it a synonym of the very different *Coralliophila bulbiformis* (Conrad). It has been found in some abundance in material dredged from Honolulu Harbor, by Professor and Mrs. Bryan, and the senior writer picked up a living specimen on the reef at Kewalo.

The shape is rather variable, as shown in the figures. The longitudinal folds, eight or ten on the last whorl, are crossed by four or five larger cords and numerous small threads. The cords and intervals are densely, minutely scaly, the whole shell being particularly rough and prickly. The shoulder is either nodular, or in some specimens spinose. There are about seven well developed teeth within the outer lip. The columella is heavy, straight, with a small, blunt, median prominence, recalling the fold of *Cymia* on a small scale.

The ground tint varies from light buff to pallid neutral gray, the summits of the folds and spines or tubercles being dull dark vinaceous. The aperture varies from fawn color to nearly white.

Two specimens measure:

Length 33.5, diam. 21.5 mm.

Length 28.5, diam. 21.5 mm.

There is also a small specimen in the Bryan collection from Ocean Island, collected by Capt. J. H. Brown.

FUSINUS SANDVICHENSIS (Sowb.) Pl. 9, fig. 8.

Honolulu Harbor channel, D. Thaanum, W. A. and E. L.

Bryan ; off Honolulu in 5–8 fms., and off Waikiki in 30 fathoms, D. B. Kuhns.

The shell is white, covered with a thin, straw-yellow cuticle, and stained with russet at the tip, having a very long anterior canal, and a long spire ; longitudinally folded, the folds broad, rounded, about seven on a whorl, crossed by numerous spiral cords, parted by wider, concave intervals, with weak, fine spirals over the cords and intervals. On the earlier post-nuclear whorls there are four large and one small spiral cords. The cuticle has minute, close longitudinal raised threads, which are slightly bristly at intersections of the spirals (the bristles deciduous, and mainly lost in dry shells). The aperture is short, oval, lirate within ; canal long and slender. The whorls are strongly convex. Embryonic shell of two whorls, the first bulbous, obliquely swollen, smooth, 0.7 mm. in diameter ; the next whorl narrower, less convex, its last half closely costulate ; the total length of the embryonic shell is 1.1 mm.

Length 71.5, diam. 19.5 mm. ; 12 whorls.

Length 105, diam. 29.5 mm. ; 12 post-embryonic whorls, the apex broken.

This species resembles *F. turricula* Kiener,[1] which however has a decidedly deeper suture, and the embryonic whorl is much larger. The type was an immature but perfect shell. The larger ones, from the "dump" of the harbor channel, are without cuticle and apical whorls. In them the folds became shortened on the last whorl, into nodes at the shoulder. It is a handsome and graceful species.

PERISTERNIA THAANUMI n. sp. Pl. 9, figs. 6, 7.

Off Waikiki in 35 to 50 fathoms, D. B. Kuhns, 1916; Honolulu Harbor, W. A. and E. L. Bryan.

The shell is fusiform, thick and solid, pecan-brown, sculpture of strong, rounded, longitudinal folds, 8 on the last whorl, continuous from whorl to whorl. These are crossed by rather coarse spiral cords, of which there are four on the penult, nine or ten on the last whorl; usually a minor cord divides the intervals ; and under the lens numerous spiral and axial threads are seen,

[1] Iconogr. Cog. vii, p. 6, pl. 5, fig. 1.

resembling a loosely woven fabric. The aperture is somewhat oblique, contracted, obtuse posteriorly, tourmaline-pink around the lips, paler, nearly white, in the throat. The outer lip is thickened within except posteriorly where it is excavated; the thickening bearing about seven teeth, the upper ones larger. The columella has two or three blunt and low but deeply entering folds. The inner lip has a thin free edge. The siphonal fasciole is deeply striate spirally.

Length 21, diam. 11 mm. (type).

Length 23.8, diam. 12.3 mm. (Honolulu Harbor).

The specimens from the Honolulu Harbor dump, though quite perfect in appearance, are evidently bleached. The color is a handsome maize-yellow, uniform, or sometimes a shade darker on the high points of the sculpture. The aperture is pure white (fig. 6.)

This species, though differing in color and sculpture, is related to *P. incarnata* Dh., "*Ricinula*" *pulchra* Reeve, and *P. carolinæ* Kiener—species somewhat like *Cantharus* or *Drupa*. A section shows that the two columellar plaits are strong within, ascending the pillar.

Drupa morus (Lam.). Pl. 9, fig. 11.

Ricinula morus Lam., An. s. Vert. vii, 1822, p. 232. Encycl. Meth., pl. 395, fig. 6 *a*, *b*.

Haena, Kauai, Honolulu Harbor; Mokumanu, off Mokapuu Point, and Kainalu, Oahu.

The specimens from the harbor are rather small, length up to about 16–18 mm., but otherwise they appear typical. A specimen from Kainalu is 22 mm. long. Lamarck referred to excellent figures in the Encycl. Methodique, but also to Lister, 954: 4, 5, and Martini III, 101: 970; both are dubious and inconclusive illustrations, which served as the sole basis of *Drupa uva* Bolten, Mus. Bolt., p. 56, no. 703. They look more like some forms of *D. tuberculata* than like *morus*; and we prefer to use the positively identified name.

The common Hawaiian species of the genus is *Drupa tuberculata* (Blainv.), which the authors have from various places in Kauai, Oahu, Molokai, and on Molokini. It occurs at low tide, and may be picked up on any reef or rocky shore (pl. 9, fig. 10.)

LIST OF SHELLS COLLECTED AT ANAHEIM BAY AND VICINITY.

BY E. P. CHACE.

Collected in the Bay.

Acanthina spirata, Blainville.
Alectrion fossata, Gld.
Alectrion mendica cooperi, Fbs.
Alectrion perpinguis, Gld.
Arcularia tegula, Rve.
Bullaria gouldiana, Pils.
Calliostoma gemulatum, Cpr.
Calliostoma tricolor, Gabb.
Cerithidea californica, Hald.
Cerithiopsis carpenteri, Bartsch
Cerithiopsis pedroana, Bartsch.
Columbella gausapata, Gld.
Columbella gausapata carinata, Hds.
Conus californicus, Hds.
Crepidula onyx rugosa, Nutt.
Crucibulum spinosum, Sby.
Haminea vesicula, Gld.
Littorina scutulata, Gld.
Lucapina crenulata, Sby.
Lucapinella calliomarginata, Cpr.
Melampus olivaceus, Cpr.
Olivella biplicata, Sby.
Olivella pedroana, Cpr.
Phasianella compta, Gld.
Polynices lewisii, Gld.
Polynices recluziana, Desh.

Cardium quadragenarum, Conr.
Cardium substriatum, Conr.
Chione fluctifragra, Sby.
Chione succincta, Val.
Chione undatella, Sby.
Cooperella subdiaphana, Cpr.
Diplodonta orbella, Gld.
Donax californica, Conr.
Heterodonax bimaculatus, D'Orb.
Macoma indentata, Cpr.
Macoma nasuta, Conr.
Mactra californica, Conr.
Modiolus capax, Conr.
Ostraea lurida rufoides, Cpr.
Paphia staminea, Conr.
Paphia staminea laciniata, Cpr.
Pecten circularis aequisulcatus, Cpr.
Petricola denticulata, Sby.
Pholas pacifica, Stearns.
Platyodon cancellatus, Conr.
Psammobia californica.
Sanguinolaria nuttallii, Conr.
Saxidomus nuttallii, Conr.
Schizothaerus nuttallii, Conr.
Tagelus californianus, Conr.
Tagelus californianus subteres, Conr.
Tellina carpenteri, Dall.
Zirfaea gabbi, Tryon.

COLLECTED ON THE SANDBARS AND BEACH NEAR THE ENTRANCE OF THE BAY. ALIVE.

Bursa californica.
Donax levigata, Desh.
Murex festivus, Hds.
Tivela crassatelloides, Conr.
Turris ophioderma, Dall.

WASHED UP ON THE BEACH AFTER STORMS, ALIVE OR VERY FRESH.

Amiantis callosa, Conr.
Chama exogyra, Conr.
Chama pellucida, Sby.
Cryptomya californica, Conr.
Glottidea albida, Hds.
Macoma secta, Conr.
Mactra hemphilli, Dall.
Mactra planulata.
Metis alta, Conr.
Modiolus flabellatus, Gld.
Modiolus rectus, Conr.
Paphia tenerrima, Cpr.
Periploma discus, Stearns.
Periploma planiuscula, Sby.
Siliqua lucida, Conr.
Solen rosaceus, Cpr.

DEAD SHELLS COLLECTED ON THE BEACH.

Bathytoma tryoniana.
Dentalium neohexagonum, S. & P.
Epitonium hindsii, Cpr.
Sinum debilis, Gld.
Turritella cooperi, Cpr.
Anomia peruviana, (upper valves).
Labiosa undulata, Gld. (broken valves).
Mactra catilliformis, Conr.
Panopea generosa, Gld.
Pecten giganteus, Gray.
Thracia plicata.
Yoldia cooperi, Gabb. (valves only).

COLLECTED ON THE PILES OF THE BRIDGE ACROSS THE ENTRANCE OF THE BAY.

Acmaea patina, Esch.
Acmaea persona, Esch.
Littorina planaxis, Nutt.
Littorina scutulata, Gld.
Cypraea spadicea, Gray. (1 only).
Lasaea rubra, Mont.
Myrina diegensis, Dall.
Mytilus californianus, Conr.

Occasionally a rock washes in on the beach containing some Lithophagus plumula, Cpr. and Kellia laperousii, Desh., and the kelp brings in Acmaea incessa, Hds. Eulima (species undetermined) has been found in a kelp holdfast and a dead Poly-

nices lewisii with 7 Crepidula excavata Brod. on it washed in after a storm.

The territory covered by this list is quite limited. It includes about 2 miles of shore along the Bay and a short distance along the ocean-front on either side of the narrow entrance of the Bay. A total distance of 3 miles of shore.

All the species listed have been collected within the last three years, most of them by Mrs. Chace and myself. A few were collected by Mrs. J. E. Herbst, Mr. Valentine Herbst and Mr. Otto Kiem of Seal Beach.

A HOME MADE VIVARIUM.

BY LILLIAN DYER THOMPSON.

I am having such success with a vivarium which I made that I thought perhaps some other conchologists might like to make some so that they, too, could study more closely the living animal, and become acquainted with the way they eat, walk, build their shells, etc.

I first bought a large roasting pan and a smaller pan that was as long as the other wide. These cost me twenty cents. Then I had a box made that the bigger pan would snugly fit and had it made six inches deep. The cover was of a fine-meshed wire netting fastened to a hinged frame. The box, of $\frac{7}{8}$" spruce stock, was made at odd moments and cost me twenty-five cents.

In one or two places, where the larger pan did not fit the case, I stuffed the cracks with wadded paper. Then I put the smaller pan across one end of the larger and filled any cracks with moss and earth.

I put a tuft of grass (which I shall supplant with a fresh-water alga soon) and a dead *Busycon* shell that I had washed to remove all traces of salt, which I have been told is injurious to snails. I then partially filled the pan with water, and my little fresh-water pond was ready for occupancy.

The remainder of the larger pan I filled with moss and bunches of grass containing growing plantain (of which the snails are very fond). As some snails love to hide under dead leaves, I put some in for them, and I also put in a stick that

formed a stairway from the moss to the cover. I knew that the snails would want some lime to aid them in constructing shell-forming material, so I put in a *Modiola* after I had washed it.

I gave them corn meal on half a scallop shell and put a *Polynices* shell full of water beside it, sinking the shell into the earth until the lip was level with the surface. The snails are very fond of corn meal; they also relish lettuce and cabbage leaves, green grass, plantain, and all succulent weeds.

As I live in Cambridge, Mass., where limestone formations are scarce, I have had largely to depend upon the kindness of others for my pets. As I have received quite a few specimens through the mail, I thought others might want to do the same; so will, in as few words as possible, tell how mine were sent. Some came way from California in a tin box, with a little grass. As they could not get much air, they built epiphragms over the apertures, which they broke down soon after they were put in the vivarium. The majority were sent with a little grass or lettuce in pasteboard or wooden boxes (which are the only things to send specimens in, as they can breathe freely).

In closing, I shall give a list of species that I now have in my vivarium, with the localities. Those with the asterisk (*) have raised families since they came.

Lymnaea palustris Müll, from Livingston Co., Michigan.

Campeloma decisum Say *, from Shawsheen River, Bedford, Mass.

Physa heterostropha Say *, from Shawsheen River, Bedford, Mass.

Planorbis antrosus Conrad *, Shawsheen River, Bedford, Mass.

Succinea ovalis Say *, Waverly, Mass.

Epiphragmophora tudiculata Binn, near Los Angeles, Cal.

Polygyra tridentata Say, Livingston Co., Mich., and New York City.

Polygyra thyroides Say, Livingston Co., Mich., and Upper Montclair, N. J.

Polygyra multilineata Say, Livingston Co., Mich.

Polygyra monodon Rach., Livingston Co., Mich.

Polygyra albolabris, Blue Hills, Mass.

Polygyra thyroides Say, Middlesex Fells, Melrose, Mass.

Zonitoides arboreus Say, Middlesex Fells, Melrose, Mass.

NOTES.

HELIX NEMORALIS IN KNOXVILLE, TENN.: One day, while playing in an alley the two small sons of Prof. J. F. Voorhees, in charge of the U. S. Weather Bureau here, found some handsome snails crawling on a brick wall, and knowing that I was making a special study of the fauna of this vicinity, brought some of them to me.

I had never seen any like them in the State, and sent some of them to Mr. Bryant Walker of Detroit for identification. He pronounced them the European species *Helix nemoralis* Linné. He said this was the first authentic colony reported to him West of the Alleghany Mountains.

He suggested it would be interesting if I could trace out how they came to be here, and send an account to the Editor of the NAUTILUS, as the readers of the NAUTILUS would be interested to know that such a colony existed here in Knoxville, Tennessee.

I made investigations, and found that the wife of Prof. Chas. C. Ross connected with the University of Tennessee brought them here.

Mrs. Ross says that eight years ago she went to visit the graves of her grandfather and grandmother who were buried in the cemetery at Lexington, Va. As she approached the tombstones she noticed they looked spotted, as if boys had marked or defaced them, but upon a nearer approach found the peculiar appearance was due to the presence of numbers of *H. nemoralis* crawling upon the face of the stones.

When Mrs. Ross came away she dug up and brought with her some of the vines and shrubs, being careful to bring with them some of the beautiful shells. She transplanted the plants in the rear of the yard, and now after 8 years, amongst dense growths of English Ivy, and on adjoining trees and other shrubbery, this colony has become thoroughly acclimated and is thriving magnificently. Mrs. Ross met the person who originally brought them from Italy to Lexington, Virginia.

—MANLY D. BARBER.

VIVIPARUS MALLEATUS AND CONTECTOIDES IN MASSACHUSETTS: Eight fresh specimens, one with the operculum in place, were

collected by Mr. C. H. Rowe, in Lake Quinsigamond, near Worcester, Sept. 29, 1917. Whether these represent a recent introduction he could not ascertain. The Boston colony referred to in THE NAUTILUS, Vol. 29, p. 36 and Vol. 30, p. 48, still exists. The colony of *V. contectoides* in the Public Garden, Boston, mentioned in THE NAUTILUS, Vol. 30, p. 72, has increased greatly during the summer, nothwithstanding that the lake was drained for a short time in the early spring.

—C. W. JOHNSON.

POLYGYRA ALBOLABRIS MARITIMA IN MASSACHUSETTS. Several years ago, when I was at Wood's Hole, Mr. V. Edwards described to me some snails which he had seen on Ram Island, off that coast, I thought he had found *H. hortensis*, and expressed a wish to visit the colony. He kindly took me to the place, and instead of *H. hortensis*, we found *Polygyra albolabris*, of a small greenish variety according well with my recollection of var. *maritima*, which Dr. Pilsbry showed me years before in the collection at Philadelphia. I think we may refer the shells to that variety or race, which is not cited in Mr. Johnson's list of New England Mollusca.—T. D. A. COCKERELL.

[I can confirm the identification from specimens sent by Prof. Cockerell.—H. A. PILSBRY].

PUBLICATIONS RECEIVED.

THE CALIFORNIAN LAND SHELLS OF THE EPIPHRAGMOPHORA TRASKII GROUP. By Paul Bartsch (Proc. U. S. Nat. Museum vol. 51, pp. 609–619, plates 114–117). This species and its allies have not been well understood. Numerous forms of the group had been named by Hemphill and others, without descriptions. Dr. Bartsch therefore undertook a revision, utilizing the considerable material contained in the National Museum and the Academy of Natural Sciences of Philadelphia, with a few specimens from other sources. Descriptions are given of—

E. cayamacensis n. sp. with the new subspecies *avus* and *venturensis*.

E. traskii (Newc.) with subsp. *tularica* new, *zechae* Pils. *proles*, *coronadoensis*, *coelata* and *phlyctaena*, new, *carpenteri* (Newc.)

As synonyms under *E. traskii traskii*, Dr. Bartsch places Hemphill's undescribed varieties *major*, *verna* and *saucius*, and *Epi. petricola* Berry. All of the species and races are figured.

This revision should lead to a further increase in our knowledge of these difficult Helices, as conchologists collecting in southern California can now identify their finds.—H. A. P.

THE NAUTILUS.

VOL. XXXI. APRIL, 1918. No. 4

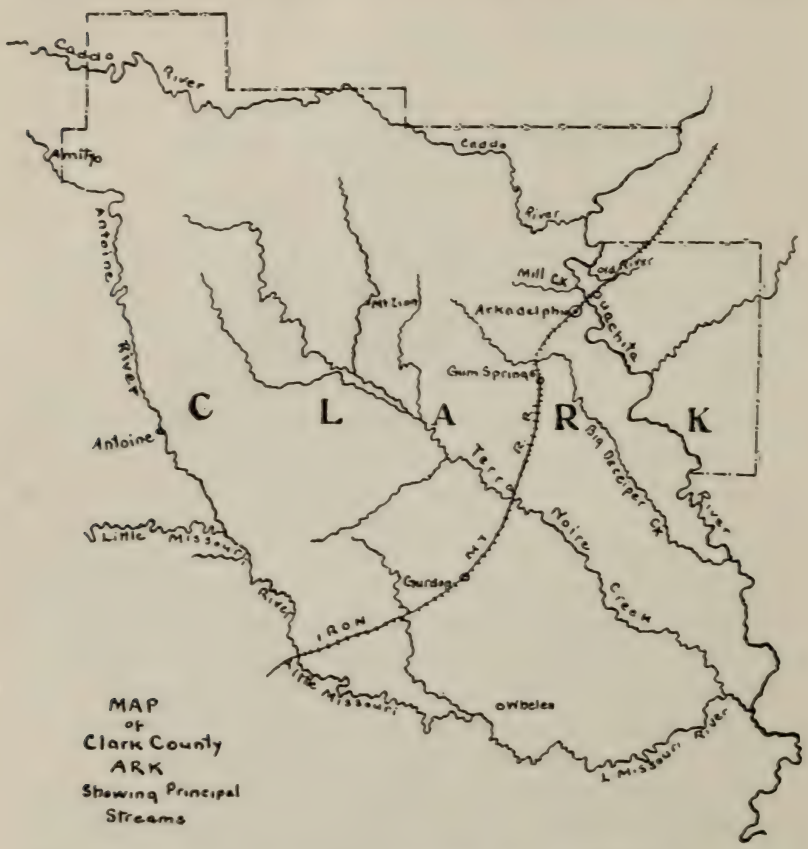
THE MOLLUSCA OF CLARK COUNTY, ARKANSAS.

BY REV. H. E. WHEELER, CONWAY, ARK.

Clark County lies in the south-central portion of the state of Arkansas and has an area of 875 square miles and a population of about 25,000. About one-third of the county—the southeastern section—is of tertiary and quarternary age. The northwestern third of the county forms a part of the southern exposure of a vast carboniferous area in the state which is generally referred to the Mississippian sub-division, and consists of non-coalbearing sandstones and shales lying above the Batesville sandstones. Between these formations lies a wedge-shaped section of cretaceous marls and clays, which form the eastern boundary of these limited rocks in the state. The alluvial lowlands of southeastern Arkansas are developing a prosperous agriculture, cotton and corn being naturally the most prolific crops, but rice is now being successfully cultivated. The county does not extend into the mountainous paleozoic region, and hence cannot boast any elevations of consequence.

The general course of the streams in the county is from northwest to southeast. The Antoine and Little Missouri rivers form the western and southern boundaries of the county, while the Caddo river crosses the county along its northern boundary, emptying into the Ouachita river some five miles above Arkadelphia. The latter river rises in the mountains of Polk County and throughout its tortuous course of several hundred miles is one of the most beautiful watercourses in the entire southwest. It passes through the eastern extension of the county, but con-

stitutes, in part, the natural boundary between the counties of Dallas and Clark. The Terra Noire creek is an intra-county stream flowing in a southeasterly course and dividing the county into two nearly equal parts. Several smaller creeks supply this vigorous stream from either side. Little Deceiper



creek is a small tributary of the Big Deceiper, and the latter creek flows in parallel direction with the Terra Noire, emptying into the Ouachita at the lower end of the county. This whole section, then, is furnished with a most complete drainage system, and the streams in question are not less inviting opportunities for an earnest and patient collector. Practically no

work, however, has been done in the Antoine or Little Missouri rivers, while the Caddo and the upper Ouachita are almost unknown to the malacologist, and promise generous remuneration to whomsoever first will require their secrets.

Although something like fifty species have been described from Arkansas,[1] and the mountainous regions of northern, central and western Arkansas have been often visited by conchologists, the fauna of the low-lands, particularly the *Unione* fauna, of the lower courses of all rivers, is practically unknown. Before a satisfactory catalogue of the Mollusca of the state can be written, not less than forty counties call for a conchological survey.[1]

A three year's pastorate in Arkadelphia,[2] the capital of Clark County, gave the writer frequent opportunities for collecting the mussels of Ouachita river and such land, and fresh-water snails as were to be had. Through the kindness of Mr. George H. Clapp the identification of the land shells has been made nearly complete, and he has determined all of the rarer forms here listed. Dr. A. E. Ortmann and Mr. L. S. Frierson have been very generous in the help given on the *Unios*, but for the most part this is the result of much patient study on the part of Dr. Bryant Walker. Most of the specimens on which the determination of the *Unionidæ* depended are now in the Walker collection.

The country around Arkadelphia would be quite discouraging

[1] The richness of the Arkansas fauna is well indicated by a comparison of species described from this state and those described from the adjoining state, Missouri, portions of each being included in the Ozarkian uplift. Exclusive of the *Unionidae*, thirty-four species have been described from Arkansas, twenty-three of which are land snails. From Missouri nine species and varieties are listed, all of which with one exception, are fresh-water forms. Consult: Simpson, "A Preliminary List of the Mollusca of Missouri," Proc. Acad. Scien. St. Louis, Vol. XXII, No. 8, p. 68, and Pilsbry's Note in the NAUTILUS, Vol. XXVIII, p. 12. This is especially significant in view of the fact that the State of Missouri has been favored with the residence of faithful and efficient conchologists, among whom may be mentioned Mr. Sampson, and more recently Professor Utterback.

[2] From November 1910 to December 1913.

to a casual collector. The swamps and "cray-fish land" offer little attraction to ambitious snails, and even the hill country has not yet organized a molluscan colonization bureau. In the cretaceous limestones of the central area the conditions are a little more promising. The entire portion of the County lying east of the Ouachita river is typical tertiary soil, but there are no exposures of strata in these lowlands, and fossils are to be secured only from occasional well borings.

Since there are many creeks and bayous the collector would expect a few colonies of *Sphaeriidæ*, or at least a larger list of the *Lymnaeidæ*. As will be seen, however, the *Unios* fully make up for any disappointment on this score. Not only are there many species and varieties, but specimens in finer condition could not be desired. The mussel beds of the Ouachita river, while worked to some extent for pearls, have not been found profitable, and button factories are too far away to make the exportation of shells for commercial purposes practicable. From the mouth of the Caddo river (five miles above Arkadelphia), the Ouachita abounds in mussel "beds" throughout the rest of its course, and the accessible and prolific breeding "bars" are less disturbed than is usually found in the experience of the uniologist. Arkadelphia was at one time the head of navigation, but steamers now seldom ascend the river above Camden.

"Old River," the type locality of the genus *Arkansia*, is really an "ox-bow" lake, a former channel of the Ouachita, and it is still connected with it by a small creek which does not appear to dry up in summer. Its mouth is about two miles north of Arkadelphia on the left bank, almost lost in a rather dense and difficultly passable swamp. Here, and for a mile or more up stream, Old River is deep and rather wide, with a very sluggish current. In this habitat are found very large specimens of *Anodonta suborbiculata* Say, which are of great beauty, and the largest specimens of *Arkansia wheeleri* Walker and Ortmann. One of the latter measured 109.25 by 87 by 58 mm. In the summer "Half-Moon Lake," the upper channel of Old River, is set off by the subsidence of water on the sand bars, and through the narrow creek which connects it with its lower course it is quite impossible to navigate even a small canoe.

Young *Arkansia* are found in the shallow waters both on the sand bars and muddy bottoms, but like other *anodontine* species they prefer the oozy mud of the river margins where there is little or no current. So far, the most patient effort to secure gravid females of this new genus has not been successful, the breeding season being winter, and the localities just described being almost inaccessible at this season.

Mr. Sampson in his "Preliminary Report of the Mollusca of Arkansas,"[1] enumerates twelve species of mollusks collected in Clark County. Five of these I have not been able to verify, namely: *Physa gyrina* (Say), which is possibly the same as *Physa anatina* of my list, *Campeloma subsolidum* (Anth.) which is certainly what is now described by Walker as *Campeloma lewisii*, *Pleurocera subulare* (Lea) which may be *Pleurocera elevatum* (Say), *Pleurocera canaliculatum* (Say), and *Goniobasis lawrencei* Lea. Mr. Call in his "Study of the Unionidæ of Arkansas,"[2] reports three species from the Ouachita collected in Clark County, namely: *Unio parvus* Barnes, *Unio subrostratus* Say, and *Unio tumescens* Lea. What Professor Call took to be *tumescens* is very likely a juvenile *Fusconaia undata* (Barnes). Many shells collected in late summer have a clear "honey yellow color," and they are "abundantly rayed over the entire surface," just as he describes the so-called *tumescens*. Lea was surely mistaken in the locality given for his type specimen, for the species belongs to the Tennessee drainage, and has not been found, so far as I am aware, west of the Mississippi River. The Arkansas range of this species is also questioned by Dr. Walker in Simpson's "Catalogue of the Naiades."[3]

Annotated List of Species.

Carychium exile H. C. Lea. Collected in one place only, a marshy pasture along Mill Creek, an insignificant stream just North of Arkadelphia.

Lymnæa columella Say. Ouachita River under the Railroad

[1] In Annual Report of the Geological Survey of Arkansas for 1891, Vol. II, pp. 179–199.

[2] Transactions Acad. Scien., St. Louis, 1895, pp. 1–65, Plates I–XXI.

[3] See in loco, p. 751.

bridge at Arkadelphia; also Caddo River near County bridge five miles North of Arkadelphia.

Lymnæa humilis modicella Say. Found in the environs of Arkadelphia; in Mill Creek; rarely in the Ouachita River margins. Rare!

Planorbis trivolvis Say. Ouachita River, Old River, and Big Deceiper Lake, nine miles south of Arkadelphia.

Planorbis dilatatus Gould. Ouachita and Old Rivers. There are possibly two forms in this lot.

Planorbis sampsoni (Ancey). Clear Lake, two miles east of Arkadelphia, and ponds south of Arkadelphia (young shells only). This species seems to be exceedingly perishable.

Ancylus kirklandi Walker. Caddo River (common) Clear Lake.

Ancylus walkeri Pilsbry and Ferriss. Ouachita River at Arkadelphia. Very rare.

Ancylus sp.? Ouachita River near Arkadelphia.

Physa anatina Lea. Mill Creek, ponds south of Arkadelphia, and Big Deceiper Creek at Gum Springs, six miles south of Arkadelphia.

Physa sp.? Clear Lake east of Arkadelphia.

Strobilops labyrinthica (Say). Arkadelphia. Everywhere common in suitable localities.

Strobilops labyrinthica texasiana Pilsbry and Ferriss. Arkadelphia. Not uncommonly there is found what seems to be a hybrid between this variety and the species proper.

Strobilops virgo (Pils). Arkadelphia, but found also in the bordering county of Grant.

Pupoides marginatus (Say). Arkadelphia.

Gastrocopta contracta (Say). Arkadelphia.

Gastrocopta contracta climeana Van. Arkadelphia, very rare.

Gastrocopta pentodon (Say). Arkadelphia.

Gastrocopta tappaniana (C. B. Ads). Arkadelphia. Collected also in adjacent counties north and east of Clark.

Succinea avara Say. Environs of Arkadelphia, not common.

Omphalina friabilis (W. G. Binn.). Arkadelphia. Very rare !

Vitrea indentata (Say). Arkadelphia ; Gurdon.

Vitrea radiatula circumstriata Taylor. Arkadelphia. Quite rare, generally associated with *arborea.*

Vitrea (*Paravitrea*) *significans* (Bland). West of Arkadelphia in the foothills. Rare!

Vitrea wheatleyi (Bland)? Arkadelphia. This species, which cannot be placed anywhere else among the *Zonitidæ* collected, is either *wheatleyi*, or a variety of it.

Euconulus chersinus trochulus (Rein.). Arkadelphia. Fairly common.

Euconulus chersinus polygyratus (Pils.)? Arkadelphia.

Zonitoides arborea (Say). Arkadelphia; also along Little Deceiper Creek, and at Gurdon. Generally distributed.

Zonitoides (*Pseudohyalina*) *minuscula* (Binney). Arkadelphia.

Gastrodonta demissa brittsi (Pils.). In the hills five miles northwest of Arkadelphia. Smaller than typical *brittsi*, and rare.

Pyramidula alternata (Say). Arkadelphia, Gurdon, Whelen, and six miles east of Whelen in the southeast end of the County.

Helicodiscus parallelus (Say). Arkadelphia, west of the town near Little Deceiper Creek. Very rare!

Circinaria concava (Say). Limestone region west of Arkadelphia, and "Big Bluff" on the Ouachita River, two miles north of Arkadelphia.

Polygyra leporina Gould. Arkadelphia and Gurdon. Common in most of the low lands.

Polygyra dorfeuilliana Lea. In low hills west of Arkadelphia, Gurdon. Rare! Nearly always found under small pieces of bark, seldom under logs and stones.

Polygyra inflecta (Say). Arkadelphia, Gurdon, Whelen, and southeastern corner of the County.

Polygyra albolabris (Say). Arkadelphia. Rare! This does not appear to be the variety *alleni* Wetherby, to which all of the shells of this type west of the Mississippi River have been referred.

Polygyra divesta (Gould). Arkadelphia, Crawford's Mill on Big Deceiper Creek, Gurdon.

Polygyra zaleta (Binney). Woods west of Arkadelphia. Rare!

Polygyra obstricta carolinensis (Lea). Typical shells collected in heavy woods along the Little Missouri River in the southeast corner of the County. Here there is much cypress. Clark County corners at the confluence of the Little Missouri and the Ouachita rivers, the former making the southern and the latter the eastern boundary line.

Polygyra clausa (Say). Arkadelphia. Generally distributed. The commonest of the *Helices* in all this region!

Polygyra stenotrema ("Fer." Pfr.). Arkadelphia and Crawford's Mill on Big Deceiper Creek.

Polygyra monodon (Rack) var. Whelen and southeast corner of the County.

Polygyra fraterna aliciæ (Pils.). Crawford's Mill on Big Deceiper Creek.

Bulimulus sp.? Fragments of a *Bulimulus* were collected in the hills west of Arkadelphia. It is probably *dealbatus* (Say).

Amnicola cincinnatiensis (Anth.). Big Deceiper Creek at Gum Springs.

Somatogyrus wheeleri Walker. Ouachita River, type locality, under railroad bridge, Arkadelphia. Rare.

Somatogyrus amnicoloides Walker. Ouachita River, type locality, under railroad bridge, Arkadelphia. Rare.

Campeloma lewisii Walker.[1] Ouachita and Old Rivers, Arkadelphia, very common; Big Deceiper Lake, nine miles south of Arkadelphia; Caddo River.

[*Pleurocera canaliculata* Say]. Reported by Sampson on authority of Call from the Ouachita River in Clark County. Not found.

Pleurocera elevatum (Say). Ouachita, Caddo and Old Rivers near Arkadelphia; Big Deceiper Lake.

[*Pleurocera subulare* (Lea)],[2] reported from Clark County, Ouachita River, by Call in Sampson,[3] was not located. Possibly young *elevata* were mistaken for this species.

[1] *Vide*, NAUTILUS, Vol, XXVIII, pp. 126, 127.

[2] *Vide* NAUTILUS, Vol, XXX, pp. 122–124, On "Pleurocera subulare, Lee," by Calvin Goodrich.

[3] See "Preliminary List of the Mollusca of Arkansas," Geol. Surv. of Ark., 1891, Vol. II, p. 197.

Goniobasis plebeius (Anth).[1] Ouachita and Caddo Rivers, Arkadelphia. Very common.

Goniobasis lawrencei (Lea), described from the Ouachita River in Garland County, was not found. Search was made for it in the Ouachita River at Cove Creek station, Hot Springs County, near the boundary of Garland County, about twelve miles east of Hot Springs, but without success.

Helicina orbiculata Say. Dead shells only were collected from creek and river drift at Arkadelphia, these being evidently brought down from the limestone hills in the western part of the County.

Lampsilis ventricosa satur (Lea). Ouachita River below Arkadelphia and at Skillern's Shoals; Old River. In form it is closely related to *excavatus*. Specimens from the Ouachita are "gorgeously appareled", some of a deep solid yellow color, others with varying and elaborate patterns of green.

Lampsilis hydiana (Lea). The Southern form of *luteola*, common in all the rivers, and also in Big Deceiper Creek on the Huie farm and at Gum Springs; also in Salt Bayou east of Arkadelphia.

Lampsilis orbiculata (Hild). Old River. This species is admitted to the list on the authority of Dr. Ortmann. In a letter dated June 5, 1911, Dr. Ortmann writes: "Among the *Lampsilis ventricosa satur* was one individual (female, sterile) which I must regard as *Lampsilis orbiculata* (Hildreth). This species also is not listed from your region. The specimen agrees in shape etc. completely with the Ohio forms of *orbiculata*, only the color is not *quite typical.*" Again on June 19, 1911: "And there is [among the shells received] a fine typical male of *Lampsilis orbiculata*, preserving even the characteristic *pink* stain of the nacre." If *orbiculata* and *ligamentina gibba* are so similar as to make differentiation difficult as is stated by Wilson and Clark,[2] then our Ouachita specimens are *not* this species.

[1] *Vide* Proc. Ac. Nat. Sc., Phila., 1900, pp. 458, 459. Both *elevatum* and *plebeius* are here figured.

[2] See "The Mussels of the Cumberland River and Its Tributaries", Bureau Fisheries, Doc. No. 781, p. 49.

Lampsilis higginsi (Lea). A fine typical series of this species was collected from the Ouachita River below Arkadelphia, at Skillern's Shoals, and also in Old River.

Lamsilis higginsi grandis Simpson. Old River. These shells are larger and *less inflated* than typical *higginsi*. The feeble posterior ridge, high beaks, shining surface, and the absence of growth ridges make the identification satisfactory.[1]

Lampsilis (*Nephronaias*) *ligamentina* (Lam.). Everywhere common in the Ouachita and Old Rivers. The common "mucket" of the pearlers.

Lampsilis fallasiosa (Smith) Simpson. A common species collected in the Ouachita River, Old River, and Terra Noire Creek. The validity of this species as distinct from *anodontoides* Lea presents no difficulty to one who has a series of shells from Arkansas localities to compare with those from regions further North. Consult Simpson's diagnosis in his "Descriptive Catalogue."

Eurynia recta (Lam.). Ouachita and Old Rivers.

Eurynia subrostrata (Say). Though not common this species has been found in Ouachita and Old Rivers, Big Deceiper Creek at Gum Springs, Big Deceiper Lake, and a few "sloughs" south of Arkadelphia.

Micromya lienosa (Con). Ouachita and Old Rivers. Rare.

Micromya lienosa nigerrima (Lea). Common in both Ouachita and Old Rivers, Big Deceiper Creek at Gum Springs, and Caddo River. The nacre is *white*, and the epidermis a lead-black, unpolished.

Eurynia (*Micromya*) *arkansasensis* (Lea). On July 28, 1913, two females from the Ouachita River south of Arkadelphia were sent to Dr. Ortmann, who reported: "I think here we have *arkansasensis* again! These agree rather well with females received previously (from you) from Saline River, Benton." The species is smaller than *lienosa*, lighter in color, and with a silvery nacre. Of the *arkansasensis* collected from the Saline River on July 13, 1911, of which there were four males and two females, Ortmann says: "Here it is! The males, although

[1]See "Descriptive Catalogue of the Naiades," Simpson, p. 78.

slightly differing from one another, agree well with Lea's original figure. The female has never been figured. According to these specimens, the species would be an *Eurynia*, subgenus *Micromya*, but the papillæ of the mantle margin are very poorly developed. They may be larger in *gravid* females." With this identification Dr. Walker is satisfied. See NAUTILUS, vol. XXX, p. 54.

Carunculina texasensis (Lea). Ouachita and Old Rivers; Terra Noire Creek; Caddo River; Big Deceiper Lake. Common.

Carunculina parva (Bar.) Ouachita and Old rivers; Caddo River; Terra Noire Creek at Mount Zion; Big Deceiper creek at Gum Springs; Big Deceiper Lake. The shells from the last named locality are different from the usual form, but are not "*corvinus*," as at first supposed.

Carunculina glans (Lea). Ouachita and Old rivers; Terra creek at Mt. Zion; Caddo River near Arkadelphia. Rare. These shells have an unusual *cream-colored* nacre, but in other respects are entirely typical.

Carunculina cromwellii (Lea). Big Deceiper creek, Gum Springs; Big Deceiper Lake; Terra Noire Creek; Caddo River, near Arkadelphia. The beak sculpture agrees exactly with *cromwellii*, and the identification is well confirmed. The beaks are unusually perfect. "This is another example of the remarkably close relationship that exists, without as yet a sufficient explanation, between the fauna of Arkansas and Alabama." Walker in letter.

Proptera purpurata (Lam.). Ouachita and Old River. Common. See Ortmann, Ann. Car. Mus., VIII, 1912, p. 334.

Paraptera gracilis (Bar.). Ouachita River below Arkadelphia, and Skillern's Shoals; Old River. See Ortmann, Ann. Car. Mus., VIII, 1912, p. 331.

Lampsilis leptodon Raf. A rare shell collected only at Skillern's shoals and in one place below Arkadelphia. So far we have been unable to secure gravid females. This species delights in burrowing under sharp and rather heavy rocks in the swiftest part of the current, and it is with difficulty that any specimens are secured.

Obovaria castanea (Lea). Ouachita River below Arkadelphia,

Skillern's Shoals and Old River. This species and *Nephronaias ligamentina* are the most prolific shells in the river. The epidermis of *castanea* is a most beautiful silken black, sometimes with a deep purple bloom, but young shells are yellowish brown and frequently rayed !

Amygdalonaias securis (Lea). Ouachita River below Arkadelphia, Skillern's Shoals, and Old River. This is considered a pearl shell. Very fine specimens are from Old River.

Amygdalonaias elegans (Lea). Ouachita River below Arkadelphia, Skillern's Shoals, and Old River. Quite common.

Amygdalonaias donaciformis (Lea). Found only in one bed below Arkadelphia and in the swift current at Skillern's Shoals. Later at Old River.

Tritogonia tuberculata (Barnes). Ouachita River, Skillern's Shoals and below Arkadelphia; Old River; Terra Noire creek. The river specimens are much inferior in size to those collected in the Tennessee drainage.

Tritogonia nobilis (Con.). Old River. *Rare!* Simpson now places this species as given.

Cyprogenia aberti (Con.). Ouachita River, Skillern's Shoals, and in many beds below Arkadelphia. Specimens are not as large as typical *aberti*, and may eventually be referred to the variety *lamarckiana* Lea.

Cyprogenia aberti lamarckiana (Lea). Ouachita River, Arkadelphia. This was also collected in the Caddo River in Montgomery County.

Obliquaria reflexa Raf. Ouachita River below Arkadelphia, Skillern's Shoals, Old River. The young are, in these localities, beautifully sculptured.

Ptychobranchus phaseolus (Hild). Ouachita River, Arkadelphia, and Skillern's Shoals; Old River. It is fairly common on the rocky shoals, sometimes on the sand bars. There seems to be no dividing line between this species and its variety *clintonense*, Simp.

Ptychobranchus clintonense Simp. Ouachita River above and below Arkadelphia, but not in Old River. Typical specimens with wavy lines are more common at Skillern's shoals. Dr. Walker is disposed to refer all Ouachita forms to *clintonense*.

Strophitus edentulus (Say). Ouachita River and Old River. In the latter locality specimens are quite thick and heavy.

Anodonta imbecilis Say. Ouachita River, Arkadelphia, Old River, and Deceiper Creek and Gum Springs. Common.

Anodonta suborbiculata Say. From Old River only. The young are perfect and most beautifully rayed. In the lower channel of the "river" they attain an unusual size.

Anodonta grandis leonensis (Lea). Ouachita River, Arkadelphia, and Old River. One must go deep in the mud for these fine shells but they are fairly common.

Anodonta virens Lea, var. Ouachita River and Old River, Arkadelphia. Distinguished from *leonensis* by having much higher and more prominent beaks, and by being less elongated.

Arkansia wheeleri, Walker and Ortmann. Old River and (rarely) Ouachita River below Arkadelphia. This is likely to remain one of the rarest of *Unios*. The nacre of this species is one of its most attractive characteristics. In young shells the entire margin is widely bordered with a rich *salmon*, in most adults it is a warm cream color, while in some specimens it is an opalescent blue. In very young specimens the plications are sometimes entirely wanting, but it could not be mistaken, even then, for any other species. Pearlers sometimes open this shell mistaking it for *Quadrula pustulosa* (Lea).

Symphynota costata (Raf.). Ouachita and Old Rivers, but very rare indeed. This species is quite common, however, in the Saline River (at Benton), and it has been a surprise not to find it more abundant in the Ouachita. It is also common in the Caddo far up in Montgomery County.

Symphynota complanata (Bar.). One specimen only was collected in 1913 in the Ouachita River below Arkadelphia. This and *Cumberlandia monodonta* (Say) remain the rarest of all the *Unios* in this region.

Cumberlandia monodonta (Say). Ouachita River above Skillern's Shoals, Arkadelphia. This record extends the range of this species much further to the southwest than was to be expected, for heretofore it has not been known west of the Mississippi *south of Iowa!* A full discussion of the distribution will be found in Walker's "Distribution of *Margaritana margaritifera*

in North America", Proc. Mal. Soc., IX, June 1910, pp. 137-139; and in "Notes on the Distribution of *Margaritana monodonta* (Say)", NAUTILUS, Vol. XXV, pp. 57, 58. For the generic data consult Ortmann, "Cumberlandia, a New Genus of Naiades", NAUTILUS, Vol. XXVI, pp. 13, 14, where this species is made the type of the genus.

Alasmidonta marginata Say. Ouachita River below Arkadelphia; Skillern's Shoals; Old River. This is also a rare species in this region.

Unio gibbosus subgibbosus (Lea). Ouachita River, Arkadelphia and Skillern's Shoals; Old River. All specimens collected have given to this variety, though some approach very closely Simpson's *delicatus*.

Uniomerus tetralasmus (Say). In "sloughs" and shallow ponds near Arkadelphia, and in Big Deceiper Creek at Gum Springs. Not found in any of the larger streams. It is common in Malvern Creek, at Malvern, Hot Springs County.

Pleurobema pyramidata (Lea). Ouachita River, Arkadelphia, and Skillern's Shoals; Old River. Common, attaining, in quiet waters, a splendid development.

Pleurobema friersoni (B. H. Wright). Ouachita River, Arkadelphia and Skillern's Shoals; Old River. The nacre of these shells is often a beautiful rose or pink, but more commonly white. They were formerly considered to be *ridellii*, but it is now agreed to refer them to *friersoni*, though they are not altogether typically that species. See NAUTILUS, Vol. XXVIII, pp. 30, 31.

Crenodonta perplicata (Con.). Ouachita River, Arkadelphia and Skillern's Shoals; Old River; Caddo River. In Old River this species attains great size, and there is little erosion on the beaks even in the largest specimens. Dr. Ortmann reports finding an Ouachita female (Old River), collected June 29, 1911, with glochidia, a very early date. See NAUTILUS, Vol. XXVIII, p. 21.

Crenodonta undulata (Bar.). Terra Noire Creek at Mt. Zion.

Crenodonta trapezoides (Lea). Ouachita River, Skillern's Shoals and near Arkadelphia; Old River. Common.

Quadrula cylindrica (Say). Ouachita River, Skillern's Shoals

and in nearly every mussel bed of the river; Old River. At Cove Creek station in Hot Springs County, specimens were collected from the Ouachita River with the cuneiform blotching wonderfully developed.

Quadrula metanerva (Raf.). Ouachita River, Arkadelphia and Skillern's Shoals. Not found in Old River. Very common. The variety *wardii* was nowhere located in this region.

Quadrula aspera (Lea). Old River; Terra Noire Creek at Mt. Zion.

Quadrula lachrymosa (Lea). Ouachita River at Skillern's Shoals and below Arkadelphia. "A comparatively small compressed form with large tubercles, quite different from the typical form." Dr. Walker in letter to the author.

Quadrula pustulosa (Lea). Ouachita River, Arkadelphia and Skillern's Shoals; Caddo River; Terra Noire Creek west of Arkadelphia; Old River. The shells from the last named locality are very perfect. Their brilliant color and handsome appearance make them easily the most attractive of all the "Ouachita" shells. Some excellent pearls have been obtained from this species. Dr. Walker distinguishes three "forms" among the Old River shells, as follows:

a. Very oblique, usually densely pustulate.

b. Quadrate, with a silky, polished epidermis.

c. Intermediate. Shaped more like "b," but in epidermis and sculpture like "a." He thinks that several local races of this species are perhaps worthy of recognition.

Fusconaia rubiginosa (Lea). Big Deceiper Creek, Gum Springs, south of Arkadelphia. Two males from this locality were stated by Dr. Ortmann to be indistinguishable in shape from the Pennsylvania specimens, but they had a lighter and more glossy epidermis. Some specimens collected in the Terra Noire Creek, west of Arkadelphia, on July 3, 1911, are more compressed than *cerina*, *chunii*, or *undata*. Dr. Ortmann says, "*Rubiginosa* is the small creek form—in Pennsylvania, passing into a more swollen form (*trigona*) in the rivers of medium size, and finally, in large rivers, into the true *undata*, with high beaks. The anatomy of all the forms named (including *chunii*, and *cerina*) is *absolutely identical.*" A form perfectly intergrading

between these Terra Noire *rubiginosas* and the Ouachita *undatas* was collected in the Saline River, at Benton, and this Dr. Walker unhesitatingly calls *cerina*.

Fusconaia cerina (Con). Caddo River, Arkadelphia.

Fusconaia undata (Bar).[1] Ouachita River, Arkadelphia and Skillern's Shoals; Old River. A common species.

Quadrula coccineum (Con.). A typical specimen was taken from the Ouachita at Arkadelphia in 1913; another was collected in June 1914.

Quadrula solida (Lea). A rare species collected only from the Ouachita River near Arkadelphia.

Fusconaia ebena (Lea). Ouachita River, Arkadelphia and Skillern's Shoals; Old River. Abundant.

Sphaerium striatinum Lam. Big Deceiper Creek five miles West of Arkadelphia; Gum Springs: Big Deceiper Lake.

Musculium transversum (Say). Big Deceiper Lake (teste Sterki).

Summary.

Pulmonate Gastropoda	45
Operculate Gastropoda	7
Pelecypoda, all of which are *Naiades* except two	60
Total species	112

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Sampson, "Preliminary List of the Mollusca of Arkansas," Published in the Annual Report of the Geological Survey of Arkansas, Vol. II for 1891, pp. 181-199.

Call, "A Study of the Unionidae of Arkansas", Transactions of the St. Louis Academy of Sciences, 1895, pp. 1-65, Plates I-XXI.

Ortmann, "Notes upon the Families and Genera of the Najades", Annals of the Carnegie Museum, Vol. VIII, No. 2, 1912, pp. 222-365, Three Plates.

Ortmann, "Studies in the Najades". Nautilus, Vol. XXVIII, pp. 129-131 (*Carunculina parva*); Ditto, XXVIII,

[1] See Nautilus, Vol. XXIV, pp. 6-10, 16-24, with plates. On the Validity of *Unio undatus*, Barnes, by Bryant Walker.

141, 142 (*Carunculina texasensis*, and *C. glans*), Ditto, XXX. 54-57 (*Eurynia lienosa*, *E. subrostrata*, and *Lampsilis ventricosa satur*).

WALKER, "On Paludina coarctata and incrassata, Lea". NAUTILUS, Vol. XXVIII, pp. 121-127. Description of *Campeloma lewisii.*

WALKER, "Apical Characters in Somatogyrus, with Description of Three New Species." NAUTILUS, Vol. XXIX, pp. 37-41, 49-53. Description of *Somatogyrus wheeleri*, and *S. amnicoloides.*

WALKER and ORTMANN, "A New North American Naiad", NAUTILUS, Vol. XXV, pp. 97-100, Pl. VIII. Description of *Arkansia* (genus) and *Arkansia wheeleri.*

NOTE.—The paper of E. G. Vanatta entitled, "Unionidæ from Southeastern Arkansas and N. E. Louisiana", NAUTILUS, Vol. XXIII, pp. 102-104, should be compared for a list of species reported from the lower Ouachita, some of which may be yet located in Clark County sections of the river.

DESCRIPTIONS OF NEW SPECIES OF MOPALIA AND TRACHYDERMON.

BY HENRY A. PILSBRY.

MOPALIA LOWEI n. sp.

The chiton is rather small, oblong, moderately elevated, carinate, the lateral slopes straight. The valves are irregularly mottled with ferruginous, sea-green and olive. The anterior valve has ten radial ribs, those at the suture bearing compressed tubercles, the others rounded tubercles. The intervals are also tuberculose, with some interstitial granulation. Valves ii to vii have low, tuberculose sutural and diagonal ribs, the lateral areas tuberculose and granular. Central areas with the jugal tract closely striate longitudinally, the striæ converging forward near the beaks, elsewhere subparallel, but slightly irregular in places. Pleural tracts having longitudinal ribs, near the ridge converging forward somewhat, becoming divergent towards the lateral borders. These are intersected by a system of much weaker curved ribs radiating forward and laterally, forming oblong tubercles on the longitudinal ribs. The posterior valve is short,

nearly flat, with a broad, shallow posterior sinus, the scarcely raised mucro being at the posterior third.

The interior is nearly white, strongly striate across the central part, where some valves may show a green or pink stain. The posterior valve has a rather deep posterior sinus and a single slit on each side.

The girdle is rather narrow in dry specimens, and bears coarse processes covered with sharp white spines.

Length 23, width 12.2 mm.

San Pedro, California, collected by Mr. Herbert N. Lowe. Type no. 117951 A. N. S. P., paratype in Lowe coll., no. 1538.

This species is related to *M. sinuata*, *M. imporcata* and *M. porifera*, but it apparently differs from all of them by the profusely spiny girdle processes, which are not exclusively localized at the sutures, though often present there, as well as scattered over the girdle elsewhere. The allied forms mentioned are all from northern localities.

In some of the specimens there are 10 to 12 ribs on the anterior valve. The younger shells are suffused with lilac inside.

MOPALIA IMPORCATA LIONOTUS n. subsp.

This chiton agrees closely with *M. imporcata* except that there is a narrow, smooth jugal tract. The lateral areas are granose between the coarsely tubercular diagonal and sutural ribs. The anterior valve has 10 ribs. Posterior valve is depressed behind the mucro, which is at the posterior fourth. Interior light Niagara-green, darker posteriorly on each valve. The girdle bears branching processes, often like the branches of spines on a cactus. These are scattered, sometimes sutural.

Length 15.5, width 9 mm. Divergence 95°.

White Point, collected by Mr. H. N. Lowe. Also San Pedro, same collector. Type no. 117952 A. N. S. P.; paratype no. 1542 Lowe coll.

MOPALIA MUSCOSA LAEVIOR n. subsp.

This name has long been used in the collection for the form

figured and described in Man. Conch., vol. 14, p. 300, pl. 63, figs. 60, 61. It is from Olympia, Wash.

TRACHYDERMON LOWEI n. sp.

Oval, rather depressed, dirty buff, a little darker towards the beaks, which project somewhat. Surface of the valves finely, closely and evenly granose throughout, the granules oblong. The anterior valve and posterior area of the posterior valve have a few very weak, low radial impressions. The mucro of the posterior valve is slightly post-median, but little raised, the slope behind it being convex towards the edge. The interior is white, stained buff or pinkish near the sinus, where it is conspicuously porous. The eaves are *wide* and closely porous throughout. Teeth smooth, those of the posterior valve being directed forward. Girdle is densely covered with minute elongate scales.

Length about 17, width 12 mm. (San Pedro).

Length about 19, width 13 mm. (San Pedro).

Length about 16, width 11 mm. (White Point).

San Pedro, Cal. Collected by Mr. H. N. Lowe. Type no. 117955 A. N. S. P., paratype no. 1545 Lowe coll.

This species is much more distinctly granulate than *T. raymondi*, and the eaves are much wider and more porous.

The paratype in Lowe coll. is from White Point. There is also a smaller specimen, red with blue-green spots, from San Pedro, but as it has not been disarticulated I do not feel certain of its identity.

DESCRIPTION OF NEW SPECIES OF SHELLS CHIEFLY FROM MAGDALENA BAY, LOWER CALIFORNIA. By W. H. Dall. (Proc. of the Biol. Soc. of Washington, vol. 31, pp. 5-8, 1918.) The following new species are described: *Scintilla chloris, Macron orcutti, Phenacolepas magdalena, Trichotropsis lomana, Liotia rammata, L. olivacea, L. cookeana*, and three new varieties.

THE IDENTITY OF THE NAYAD-GENUS NODULARIA CONRAD WITH UNIO RETZIUS.

BY DR. A. E. ORTMANN.

The type of Conrad's genus *Nodularia* (Proc. Ac. Philad. 6, 1853, p. 268) is *Unio douglasiae* Griffith & Pidgeon. Simpson (Syn., 1900, p. 806, and Descr. Cat., 1914, p. 949) has associated, in this genus, a large number of species from Asia and Africa, and places it in his subfamily *Hyriancæ*, to which he assigns radial beak sculpture and a marsupium formed by the inner gills only, the latter character resting upon the observation of two species only.

Already Haas (System. Conchyl. Cabinet, vol. 9, Heft 44, 1911, p. 65 ff.) has pointed out that this conception of *Nodularia* cannot be maintained, since just the type-species (*douglasiae*) does not possess the characters assigned to the subfamily by Simpson: its beak sculpture is essentially of the zic-zac type, and its marsupium is formed by the outer gills. His examination of this species (and several others, l. c., p. 67) has revealed several other differences from Simpson's description of the anatomy of *N. japanensis*, and, as far as it goes, we are to conclude that "*Nephronaias douglasiae*" is not allied to the Hyriine type of Nayades, but rather to that type represented by *Unio* Retzius (1788) in the restricted sense as defined by myself (Ann. Carnegie Mus. 8, 1912, p. 273); that is to say, it belongs to the family *Unionidæ*, subfamily *Unioninæ*. This is clearly shown by the existence of a supraanal opening separated from the anal ("Mantelschlitz unten geschlossen"), and by the marsupium.

From the characters of the shell, chiefly the zic-zac beak sculpture, it was to be inferred that *U. douglasiae* comes close to the genus *Unio* (compare my key of genera, l. c., pp. 239 and 240); but the chief character of *Unio*, the subtriangular, hooked glochidium, has not been observed hitherto, the gravid females investigated by Haas having only eggs, and not glochidia.

Recently Mr. B. Walker has been kind enough to send to me the soft parts of two gravid females of *U. douglasiae* Griff.

& Pidg., which had been communicated to him by Mr. L. P. Gratacap of the American Museum, New York. They are from Wladiwostok, southeast Siberia. Both had glochidia, which proved to be similar to those of *Unio*.

The examination of these specimens has established the following facts: All of the features of the family *Unionidæ* (l. c., p. 223) are present. The diaphragm is complete, and formed only by the gills (no mantle connection between anal and branchial openings), and the outer lamina of the outer gills is connected with the mantle to its posterior end. The anterior end of the inner gills is separated from the palpi by a gap. A supraanal opening is separated from the anal by a mantle connection. The gills possess continuous septa, forming water tubes running parallel to the gill filaments.

The characters of the family *Unioninæ* (l. c., p. 224) are also present. The marsupium is formed by the outer gills, and, when charged, these gills swell only moderately, leaving the edge sharp. There are no secondary water tubes.

For the rest, it should be said that the mantle connection between anal and supraanal openings is moderately long, about half as long as either. The anal has the inner edge distinctly crenulated; the branchial opening has distinct papillæ; but in front of the branchial the mantle edge is smooth. *Palpi* subfalciform, their posterior margins united for about one-third of their length.

Gills rather long and narrow, the inner the wider, chiefly anteriorly; their anterior ends as usual. Inner lamina of inner gills free from abdominal sac posteriorly, but connected anteriorly; in one of my specimens the connection extends to one-third of the length of the abdominal sac, in the other to nearly one-half of it: thus this character is variable, as in certain other forms of Nayades (Haas says only: connected anteriorly).

Septa and *water tubes* well developed in the outer gills of the female, this character extending all along the gill. *Placentæ* present, but not very solid, the glochidia easily falling apart. *Glochidia* essentially agreeing with those of *Unio* [type, *pictorum* (L.); see Ortmann, Naut., 28, '14, pp. 32,

33]. They are subtriangular in outline, and have spinulose hooks. However, they differ in being slightly oblique, the point of the ventral margin being placed a little posteriorly, so that the anterior portion of the ventral margin is longer than the posterior; the point is also sharper (more projecting); and, finally, they are smaller, and longer than high. While, in *U. pictorum*, L. and H. are 0.21 mm., in *U. douglasiae* the L. is 0.18 mm. and the H. is 0.15 mm.

Thus it is perfectly clear that *U. douglasiae* has the typical anatomical structure of the genus *Unio* (s. s., type *U. pictorum*), and that it cannot be separated from that genus on anatomical grounds. The question is, whether shell characters permit such a separation, and in this respect it should be pointed out that the general shape of the shell, the hinge teeth, and other characters are very like those of *U. pictorum*, and that the chief difference is in the beak sculpture, which is more complex, and covers more of the disk (upon this character Conrad seems to have relied when he created *Nodularia*. But when we compare other species, for instance the European *U. tumidus* Retz., we see that in all these species the beak sculpture is of the same general type, that is to say, of the zic-zac pattern, and that *U. douglasiae* represents the most extreme development of this, while *U. pictorum* has it in much obliterated condition, and *U. tumidus* is intermediate between these to a degree. Thus there is only a difference in the degree of development, and it should also be born in mind that even in *U. douglasiae* the beak sculpture varies a good deal (see the account given by Haas of the various forms of *douglasiae*).

Consequently we cannot escape the conclusion that *U. douglasiae* is a true *Unio* in all respects, and that it should stand as *Unio douglasiae* Griffith & Pidgeon. *Nodularia* Conrad, with *douglasiae* as type, becomes then a synonym of *Unio* Retzius.

This, probably, refers to those species which are related to *douglasiae*, that is to say, preëminently to all those associated by Haas in the "group of *N. douglasiae*." It remains to be seen what should become of the other species of *Nodularia* in

Simpson's sense. They cannot be called any more by this generic name, but where they finally will land cannot be told before they have been examined as to their anatomy. Already Haas has separated a number of them under other generic names, but these genera are mostly founded upon shell-characters only.

THE GENUS ELYSIELLA (VERRILL OR BERGH?).

BY SILAS C. WHEAT.

In 1872 Prof. A. E. Verrill and Dr. Rudolph Bergh each found an undescribed Nudibranch, and each erected a new genus for his species. As the forms were minute and resembled *Elysia* both authors chose the name *Elysiella*. The two species have in common the respiratory sac on which Verrill founded the genus, although they differ in the form of the head and tentacles, on which Dr. Bergh lays emphasis.

On the question of priority,—Prof. Verrill published his genus *Elysiella* in the American Journal of Science for April, 1872; Dr. Bergh published his *Elysiella* in Heft iv, Band I, Malacologische Untersuchungen in Dr. Semper's Reisen im Archipel der Philippinen. Dr. Bergh's *Band I* was issued at the rate of one *Heft* each year except in the year 1872 when both *iii* and *iv* appeared. Probably *Heft iv* came out in the autumn of 1872, several months later than the American Journal for April. A letter addressed to the publisher in Germany during the second month of the present war remains unanswered. Inquiries of American libraries for the month on which they received *Heft iv* have brought only the year 1872, copied from the title-page, not from their accession records. It seems proper to credit the genus to Prof. Verrill.

Genus Elysiella Verrill.

"*Elysiella*, gen. nov. Allied to Elysia and Placobranchus. Head rounded, with two short, obtuse tentacles; eyes sessile behind the bases of the tentacles on the neck. Lateral lobes united behind, rounded and separate in front, and raised from the back, leaving a cavity beneath for respiration.

Bloodvessels, commencing in the anterior part of the back, extend backward forking and diverging in the area enclosed by the lateral lobes. This genus differs from Placobranchus and Elysia in having the lateral lobes united together posteriorly over the back so that the respiratory cavity partly enclosed by them is closed behind." — Verrill, Amer. Jour. Soc., April, 1872, p. 284, pl. 7, f. 5–5*a*.

"Genus *Elysiella* Bergh. Head laterally subcarinate; tentacles minute, conic. This somewhat doubtful genus is based upon the new form of Elysian stated below. Undoubtedly the same differs from all known Elysians. The head on the side is carinated almost as in *Limapontia*; the tentacles are quite small and conic."—Bergh, Mal. U., Band I, Heft iv, p. 201, pl. 9, f. 3; pl. 24, f. 20-25.

Continuing, Dr. Bergh says of this new form of Elysian: "*Elysiella pusilla* Bergh. Color grass-green, punctate on both sides with minute obscure dots; on the margin of the body small white dots in one or two series, and *at the extremity a sac;* tentacles with small white dots. Length 2 mm." A single specimen found by Dr. Semper in the East Indies in 1862 was preserved in Damar balsam and was delivered to Dr. Bergh about eight years later. (The italics are mine.—S. C. W.)

Elysiella catula Verrill. Amer. Jour. Soc., 1872, April, p. 284, pl. 4, f. 5–5a.—Inv. of Vineyard Sd. (U. S. Fish., 1872, pt. 1), 1873, p. 668, pl. 25, f. 172—*not f. 171*, and *not Placobranchus catulus* Gould.

On plate 25, U. S. F., 1872, the numbers 171 and 172 are transposed. Prof. Verrill believed that Dr. Gould's *Placobranchus catulus* (Inv. Mass., 1870, p. 256, pl. 17, f. 249-250) was founded on specimens of the same species from Boston Harbor, and did not give a new name to the type of his genus. He says: "This species is well described by Dr. Gould, but the figure is incorrect in representing the lateral lobes as separate posteriorly — perhaps a theoretical mistake on the part of the artist. It is common in harbors and estuaries from Boston[?] to New Jersey. Great Egg Harbor, N. J. (Verrill & Smith); New Haven, Ct., and Woods Hole, Mass. (Smith)."

Dr. Gould's description agrees perfectly with his figure. Both text and figure prove that his *Placobranchus* was a true *Elysia* with lateral lobes not united dorsally. He says: "Body ovate-lanceolate, the lateral expansions about two-thirds its length and not quite meeting when reflected upon the back."

The species will stand thus:

Genus ELYSIELLA Verrill, 1872: type
Elysiella catula Verrill, 1872.
Elysiella pusilla Bergh, 1872.

Genus ELYSIA: *Elysia catula* Gould (*Placobranchus catulus* Gould, 1870).

HELIX NEMORALIS AT KNOXVILLE, TENNESSEE.

BY T. D. A. COCKERELL.

Mr. M. D. Barber has very kindly sent me a series of *H. nemoralis* collected at Knoxville; descendants of the Lexington, Va., colony, as explained by him in NAUTILUS, xxxi, p. 107. The specimens all have the yellow ground color (var. *libellula*), and sort out as follows:

Adults.

00000.	16, four of which are *bimarginate* (the dark peristome bordered inwardly with a white rib).
10345.	2, one having max. diam. 26 mm.
12345.	21, of which five are *bimarginate.*
123(45).	14, of which two are *bimarginate;* two have max. diam. 25 mm.
$123_4 45$.	one.

Immature.

00000.	16.
12345.	15. Some would doubtless have become 123(45) on maturity, the formula being taken from near the mouth.
123(45).	six (var. *reaumuria* Moq.).
(12)3(45).	three.
10345.	two (var. *argenvillea* Moq.).

(12345). one (var. *kleinia* Moq.).
(12)345. one.
12×345. one.
00345. one (var. *listeria* Moq.).
1(23)(45). one (var. *brardia* Moq.).
$_1$0345. one.

Every one of these band varieties is known from the Lexington colony (*cf.* J. L. Howe, American Naturalist, Dec., 1898). Among 102 shells are two with split or extra bands, which is scarcely half the percentage of such forms in the Lexington colony. It would require a much larger collection to show whether this is accidental. The absence of the varieties with a pink ground, of which 40 are reported from Lexington, is remarkable.

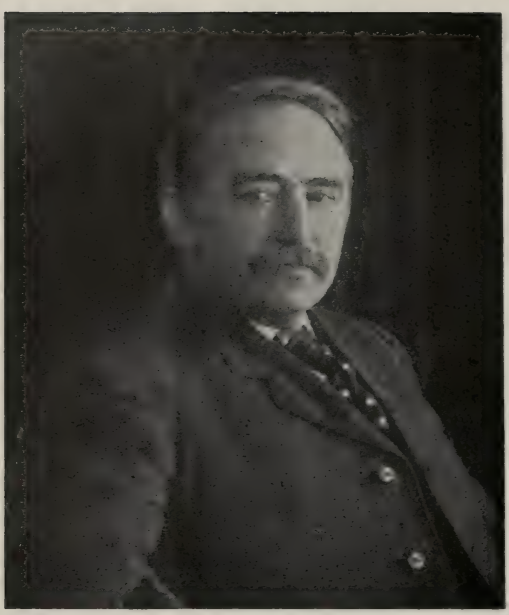
DESCRIPTION OF A NEW PANDORA OF THE SUBGENUS KENNERLYIA FROM FORRESTER ISLAND, ALASKA.

BY GEORGE WILLETT.

During the summers of 1916 and 1917 a Kennerlyia which seems to differ materially from previously known species of the subgenus was taken by the writer at Forrester Island, southeastern Alaska, at an average depth of about fifty fathoms. A considerable number of living specimens were secured and, when carefully compared with specimens of allied species, certain distinctive characteristics seem to be maintained throughout the series. Therefore I propose for this shell the following name:

Kennerlyia forresterensis, new species.

Shell moderately heavy; short and deep (depth in twelve typical specimens averaging .67 of length). Color white, with brownish periostracum generally visible on both ends but most conspicuous on posterior. Left valve moderately convex, smooth except for rather faint incremental lines. Right valve flat or slightly convex, except near basal margin where it becomes abruptly concave; smooth except for several (generally 7-9) irregular impressed lines running from apex to basal



LOUIS POPE GRATACAP

margin. Length 22, height 15, diameter 5, beaks behind anterior end 6.

Distribution. — Type locality Forrester Island, Alaska, in 50 fathoms. A. N. S., No. 118200. Paratypes are in the California Academy of Sciences and in the collection of the writer.

In shape of shell *forresterensis* is about midway between *K. grandis* Dall and *K. glacialis* Leach. It differs from *grandis* in smaller size, lighter structure, greater proportional diameter, more truncate posterior end and in straight or nearly straight hinge-line, the basal curve meeting the posterior dorsal margin at an angle a little greater than a right angle. It differs from *glacialis* in greater size, heavier structure, greater proportional depth, and in prominence of impressed line setting off anterior portion of left valve and inset at basal margin, which, however, is less prominent than in *K. grandis*.

LOUIS POPE GRATACAP.

Louis Pope Gratacap, curator of mineralogy and of mollusk, at the American Museum of Natural History, died suddenly on December 14, 1917. Born in Brooklyn, N. Y., November 1s 1851, he was educated in the College of the City of New York and Columbia School of Mines, graduating from the latter in 1876.

"Mr. Gratacap has been identified with the American Museum of Natural History since October 1876, when the collections were still housed in the old Arsenal Building. Since the death of Professor R. P. Whitfield, he has been dean of the scientific staff, having been in service more than forty years. During this period he has held successively the positions of assistant curator of mineralogy, assistant curator of geology, curator of mineralogy and conchology and curator of mollusca, the last of these since 1909, when he was placed in entire charge of the mineralogical and conchological collections".

Of his many papers upon various subjects, only a few relate to conchology. In 1901 he published a "Catalogue of the Binney and Bland collection of Terrestrial Air-breathing Mollusks of the United States and Territories in the American Museum of Natural History, with Enumeration of Types and

figured Specimens, and Supplementary Notes". The paper is illustrated by six maps showing the distributional intensity of Zonites, Polygyra (typical), Stenotrema, Triodopsis, Mesodon, and Epiphragmophora. Mr. Gratacap contributed several articles to THE NAUTILUS including "Note upon the insufficiency of the operculum as a basis of classification in the round-mouth shells" and "Tertiary fossils on Long Island". He also published, Geology of the City of New York, 1901, 3rd edition 1909; Guide to the Mineral Collections; "The Museum", a valuable paper on museums and museum technique; A Trip around Iceland, and others.

Mr. Gratacap was a man of pleasing manners and always had a warm welcome for visitors to his department.

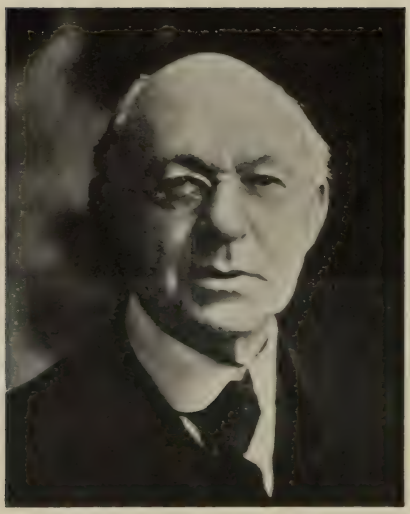
HENRY W. WINKLEY.

The Rev. Henry W. Winkley, rector of the Calvary Episcopal church, Danvers, Mass. died at his home, February 4, 1918. Born in Boston, Mass., March 24, 1858, he graduated from Harvard University in 1881 and from the Episcopal Theological School in 1884. He was ordained rector of Grace Episcopal church, Newton, Mass. in 1885 and later was rector of churches in St. Stephens, New Brunswick, Saco, Me., and Branford, Conn.

Mr. Winkley had for many years taken a great interest in the study of mollusks, contributing since 1891 over thirty articles to the pages of THE NAUTILUS, giving interesting accounts of his various collecting trips along the New England and Canadian coasts, with many useful hints as to methods of collecting. He described three new species, *Caecum johnsoni*, *Pyramidella bartschi* and *Odostomia katherinæ*, while a number of species were named in his honor. His entire collection of shells went to the Museum of Comparative Zoology, Harvard University.

He was a most enthusiastic and careful collector, specializing on New England mollusks, his favorite places for collecting being Woods Hole, Mass. and Eastport, Me., although he has collected at most of the favorable collecting grounds along our coast. He also enjoyed collecting the small fresh-water species and was an expert in the use of the sieves, obtaining Sphaeriidae

REV. HENRY W. WINKLEY



FRANCIS ASBURY SAMPSON

by the thousand. He had a keen sense of humor and always saw the bright side of life. We shall greatly miss his frequent visits to the museum.

Mr. Winkley was a charter member and the first Secretary and Treasurer of the Boston Malacological Club. He leaves two sons, Frank H. and Robert L. Winkley, and a daughter, Miss Ruth Winkley. C. W. J.

FRANCIS ASBURY SAMPSON.

Prof. Francis Asbury Sampson died of pneumonia at the Parker Memorial Hospital, University of Missouri, on the morning of February 4th at the age of 76. Prof. Sampson was born in Harrison County, Ohio, February 6th, 1842, from which place he emigrated to Missouri in 1867, locating at Sedalia, Pettis County, where with a brother he engaged in the practice of law. He enjoyed a lucrative practice and for twenty years acted as legal advisor and vice-president of the Missouri Trust Company.

From the time he came to Missouri he had been an active collector of Missouriana and his private collection of books and pamphlets, relating to Missouri and Missourians is the most complete known.

In 1901 Prof. Sampson was elected Secretary of the Missouri Historical Society and his library of Missouriana was presented to the society. The collection represented approximately twenty thousand titles.

As secretary of the Historical Society he gave his entire time to building up the library and owing to his efforts the society today has the largest library on Missouri history in existence, consisting of sixty thousand different titles. Its value cannot be appreciated except by one who has examined its contents and understands their rarity.

Prof. Sampson gave his leisure moments to collecting shells and fossils and in late years it was his only recreation. The vast number of carefully selected land and fresh-water shells contained in his cabinets bear witness to the fact that his "idle moments" were not in any sense wasted. The writer once

heard him say that he had discovered over two hundred new species of fossils and recent shells. He wrote but little on his discoveries in conchology and paleontology but generously turned them over to those especially interested. Of the numerous finds made by him, at least twenty-five species bear his name.

Prof. Sampson received his A.B. degree from the College of the City of New York, in 1864 and an A.M. and LL.B. at New York University in 1868. Prof. Sampson was a member of the American Historical Society, The Mississippi Valley Historical Association, The Academy of Sciences of St. Louis. He was a Delta Kappa Epsilon, a Phi Beta Kappa and a Knight Templar. The bulk of his writings relate to library work, consisting in the main of bibliographies and catalogues. The following list covers his work in conchology and kindred subjects.

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Annual Report of the Geological Survey of Arkansas for 1891, Vol. 2, pp. 179-199, Little Rock, 1893.

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THE NAUTILUS, Vol. 8, No. 2, p. 18, June, 1894.

Arkansas shell collecting.
THE NAUTILUS, Vol. 25, No. 4, pp. 40-41, August, 1911.

Polygyra albolabris alleni Wetherby and other Missouri Helices.
THE NAUTILUS, Vol. 25, No. 11, pp. 130-131, March, 1912.

Shells of Southeast Missouri.
THE NAUTILUS, Vol. 26, No. 8, pp. 90-95, December, 1912.

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Transactions Academy of Science, St. Louis, Vol. 22, No. 3, pp. 67-108, July, 1913.

Postpliocene shells of Providence and Lupus, Missouri.
THE NAUTILUS, Vol. 28, No. 2, pp. 15-17, June, 1914.

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THE NAUTILUS, Vol. 29, No. 11, pp. 128-129, March, 1916.

DARLING K. GREGER.
Department of Geology, University of Missouri.

PUBLICATIONS RECEIVED.

NOTES ON THE VICTORIAN SPECIES OF BULLINUS. By Charles Hedley (Records of the Australian Museum, vol. 12, pp. 1-8, pls. 1-2, 1917). The following interesting note preceeds the systematic treatise of the species: "Those fresh-water snails once known in Australia as *Physa*, but now referred to as *Bullinus*, have recently acquired an unpleasant interest. For the spread and nurture of haematura, a severe, painful and incurable complaint has recently been traced to Egyptian representatives of *Bullinus*.

"The newly hatched embryo of a Trematode, called *Bilharzia*, enters the *Bullinus* snail and there turns into a sporocyst. Then Bilharzid cercariæ are discharged from the infected snail every day for weeks, more plentifully and continuously in summer. The free-swimming larvæ swarm on the surface of the water in search of a victim. Should they fail to find a host within forty-eight hours they must die. A successful parasite enters the human body either by the mouth or through the skin, and proceeds to establish itself in the rectum or bladder. Arrived at maturity, the parasite sheds innumerable hard-shelled eggs. These erode the mucous membrane, thus causing internal bleeding, a symptom of the disease. Victims may even die from necrosis of the liver or blockage of portal veins."

It is to be presumed if this plague were to be introduced from Africa or Asia, the Australian species of *Bullinus* would serve as an intermediate host and so transmit it. Previously an Australian *Bullinus* had been indicated as an intermediate host for the sheep fluke.—C. W. J.

THE ECONOMICS OF TROCHUS NILOTICUS. By Charles Hedley (The Australian Zoologist, vol. 1, pt. 4, pp. 69-73, pl. 6, 1917). A very interesting account of its economic value, distribution, etc. Its dense, firm nacre proves good material for buttons, and during the past six years the demand for Trochus by button-makers has caused the price to advance from twenty to thirty pounds a ton. The export of Trochus from Queensland in 1916 was 950 tons, worth £23,000. The Philip-

pines export about 320 tons annually. The more careful of the Japanese fishermen save both meat and shell. From ten tons of shell a ton of meat is obtained, worth in China £20 a ton. Dried and smoked for two days, it is then ready for export, and is considered a delicacy.—C. W. J.

The Cercarial Infection of South African Snails. By F. G. Cawston, M. D. (Reprint from The Medical Jour. of S. Africa, 18 pp., 1917.) The species of snails harboring various kinds of cercariæ are given, with special reference to *Physopsis africana*, which harbors the Bilharzia cercariæ. After describing his work on this line, the following is part of a summary: "The foregoing experiments and observations would seem to show that the urine of a person who harbors the Bilharzia parasite in South Africa becomes dangerous to the community only when it reaches fresh water containing specimens of *Physopsis africana*. It is interesting to observe that the intermediary host of *Schistosoma haematobium* both belong to the same subfamily of molluscs, *Limnæinæ*, *Physopsis africana* in South Africa and *Bullinus dybowski* in Egypt; that the intermediary host of *Schistosoma mansoni* belongs to the *Planorbinæ* — *Planorbis boissyi* in Egypt and *Planorbis guadelupensis* in South America; whilst the intermediary host of *Schistosoma japonicum* is *Blanfordia* (*Katayama*) *nosophora* (Robson)."—C. W. J.

Furesöens Molluskfauna, by C. M. Steenberg (D. Kgl. Danske Vidensk. Selsk. Skrifter, Naturv. og Math. Afd., 8, Raekke III, 1, 1917, pp. 78-200, Tar. I–VIII). A very exhaustive account of the bathymetric distribution and variation of the molluscan fauna of Furesö, a lake near Copenhagen, with a comparison of the bathymetric distribution of the mollusca in other European lakes. A résumé is given in French. The illustrations are excellent.

Anatomie des Acanthinula et des Vallonia. Les organes génitaux. Par C. M. Steenberg. (Vidensk. Meddel. fra Dansk Naturh. Foren., Bd. 69, 1917.) The minute size of

these snails has hitherto hindered a knowledge of their anatomy, the accounts given by Lehmann being very incorrect. *Acanthinula aculeata* proves to have genitalia comparable to those organs in *Pupillidæ*. *A. lamellata* Jeffr. is without male end organs (vasdeferens and penis). This condition Mr. Steenberg is disposed to regard as secondary. *Vallonia costata* has pallial and reproductive organs of the group *Orthurethra*. Mr. Steenberg has rendered an important service in working out the characters of these difficult snails.

The Philippine Land Shells of the Genus Amphidromus. By Paul Bartsch. Bull. U. S. Nat. Mus., no. 100, pp. 47; 22 plates. Having at hand a large amount of authentically localized material, Dr. Bartsch has been able to trace relationships and define species and subspecies in this difficult group of beautiful tree snails with precision and detail not reached hitherto by the authors who have treated of them. The Philippine series is traced to two routes of migration from Borneo, one through Palawan to the Calamianes, the other by way of the Jolo group to Mindanao, etc. On Mindanao the relation of topography to the distribution of species and races suggests to the author "that this island is composed of a series of smaller islands which have been fused into the large territory by a comparatively moderate raising of that part of the ocean floor." Numerous new forms are described, and all are figured.—H. A. P.

Some New Species of Amastra. By C. Montague Cooke. Occasional Papers Bernice Pauahi Bishop Museum, vol. 3, no. 3, pp. 29, 3 plates. While this paper is especially valuable on account of the new forms made known from Kauai (6) and from Hawaii (9), there are also interesting species from Oahu, Molokai and Maui. Two sinistral species (one Pleistocene) from Maui, and one Pleistocene species from Oahu are added to the short list of sinistral Amastras. *A. hitchcocki* is a very large new Amastra from Molokai. Many of the new forms are from Pleistocene deposits. Excellent photographic figures are given.—H. A. P.

An Unusual Extension of the Distribution of the Shipworm in San Francisco Bay, California. By Albert L. Barrows. (Univ. of Cal. Publications in Zool., vol. 18, no. 2, pp. 27-43, 1917.) A valuable contribution to our knowledge of shipworms. "It is said that the shipworm was unknown in San Francisco Bay in the early history of the port, and that wood-boring molluscs did not become an extensive menace to marine woodwork here until some years after the great increase in the shipping entering the bay which followed upon the discovery of gold in California. Be that as it may, a species of the Teredidæ, *Xylotrya setacea* Tryon now thoroughly infests the main portion of the bay. . . . Another species of shipworm, *Teredo diegensis* Bartsch, has also recently caused damage in the upper part of San Francisco Bay."

In conclusion, the author states that *T. diegensis* may be an intermittent resident of the vicinity of Mare Island; that the excessive damage caused by this borer in 1913 came about through the marked increase in the average salinity of the water in this part of the bay, caused by two consecutive dry seasons. A salinity of at least 10 parts per 1000 (approximately) seems to be required for the existence of *T. diegensis* at temperatures ranging from 6° to 19° C.—C. W. J.

A Systematic List of the Marginellidæ. By J. R. Le Brockton Tomlin. (Proc. Mal. Society London, vol. 12, pp. 242-306, 1917.) A very useful list in which the author has endeavored to bring together all specific and varietal names that has ever been used, giving the synonymy and reference to where each species is described. The list contains some 950 names representing 519 species.

Pirates of the Deep—Stories of Squid and Octopus. By Paul Bartsch. (Annual Report Smith. Inst., 1916, pp. 347-375, 19 plates.) An exceedingly interesting review. A brief account of their past history is followed by a number of narratives of the captures of some of these remarkable creatures, together with much useful information pertaining to their economic use.

NOTES.

NOTE ON A PREOCCUPIED NAME IN POLYPLACOPHORA.—Mr. Tom Iredale has recently been good enough to call my attention to the fact that the specific name *pilsbryanus*, recently proposed by me [1] for a chiton dredged by the United States Fisheries steamer *Albatross* off the coast of Japan, is preoccupied in the genus *Ischnochiton*, where I had placed it, by *I. pilsbryanus* Bednall, 1896,[2] a South Australian species. Although it is by no means certain that the *Lepidozona* group to which this species belongs is correctly referred to *Ischnochiton* even as a subgenus, the fact that it was so referred in my paper as printed necessitates the adoption of a new name for the later species. The Japanese form I therefore propose to denominate *I.* (*L.*) *nipponica*.

It was my intention originally to describe the species as an outright *Lepidozona*, but, not being ready to give my opinion as to the proper position for the group, I thought it wisest in the final draft of the paper conservatively to refer it back to *Ischnochiton*. It happened at that time that Bednall's paper was inaccessible to me, and this fact, together with my unfamiliarity with its contents, prevented my discovery of the existence of his prior name until too late for the proper correction to be made in my paper.—S. S. BERRY.

I ran into a curious bit of coincidence on Cerros Island. I took *Epiphragmophora veatchii* only on one very peculiar tree and never more than two to a tree. I brought home the flowers and leaves, which I sent to the California Academy for diagnosis. The tree turns out to have been taken originally on Cerros Island. It was described originally as *Rhus veatchiana*, and Dr. Gray afterwards made a genus *Veatchia* for it.—FRED BAKER.

[1] Proc. U. S. Nat. Mus., vol. 54, pp. 1, 10 (1917).
[2] Proc. Malac. Soc. London, vol. 2, p. 142 (1896).

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